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LECTURES ON CONSUMPTION



DR. BURNEY YEO



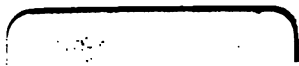
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ON
PULMONARY CONSUMPTION

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THE CONTAGIOUSNESS
OF
PULMONARY CONSUMPTION
AND ITS
ANTISEPTIC TREATMENT

TWO LECTURES DELIVERED IN KING'S COLLEGE HOSPITAL
IN THE SUMMER SESSION OF 1882

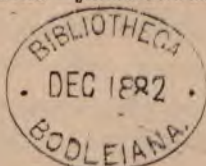
WITH APPENDICES AND NOTES

BY

J. BURNEY YEO, M.D.

FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS; PHYSICIAN TO KING'S COLLEGE HOSPITAL
AND HON. FELLOW OF KING'S COLLEGE; FORMERLY SENIOR ASSISTANT
PHYSICIAN TO THE BROMPTON CONSUMPTION HOSPITAL

"That Man, who is rapidly subduing all the most Titanic forces of the universe to his commonest uses, should always remain at the mercy of these ignoble things, is an antithesis too extreme to be permanent. The subjection of the powers of nature to our will has always seemed to me to imply, as a strictly correlative achievement, the putting the plagues of nature under our feet."—*Quoted in Dr. William Budd's Essay on 'Typhoid Fever.'*



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1882

PREFACE

I HAVE not hesitated to accede to the request that I should publish the following Lectures in a separate form. They refer to subjects of such vast importance, upon which it is so necessary that the observations of every member of our profession should be thoughtfully directed, that I venture to hope the prediction of a distinguished correspondent, that their publication "*must do good*," will be fulfilled.

I have endeavoured to avoid all exaggeration, and to set before the profession, as clearly as possible, the state of the argument as based on the results of the latest pathological inquiries.

In an appendix to the first Lecture I have reproduced the original memorandum on the 'Nature and the Mode of Propagation of Phthisis,' published by the late Dr William Budd, of Clifton—a document of peculiar inte-

rest at this moment. And I have collected, in an appendix to the second Lecture, a considerable amount of testimony from practitioners of eminence and reputation bearing on the antiseptic treatment of phthisis.

I have also added an account of the properties of the various antiseptic agents which may be employed in the treatment of pulmonary consumption, as well as other notes which I have thought calculated to throw light on these inquiries.

HERTFORD STREET, MAYFAIR ;
July, 1882.

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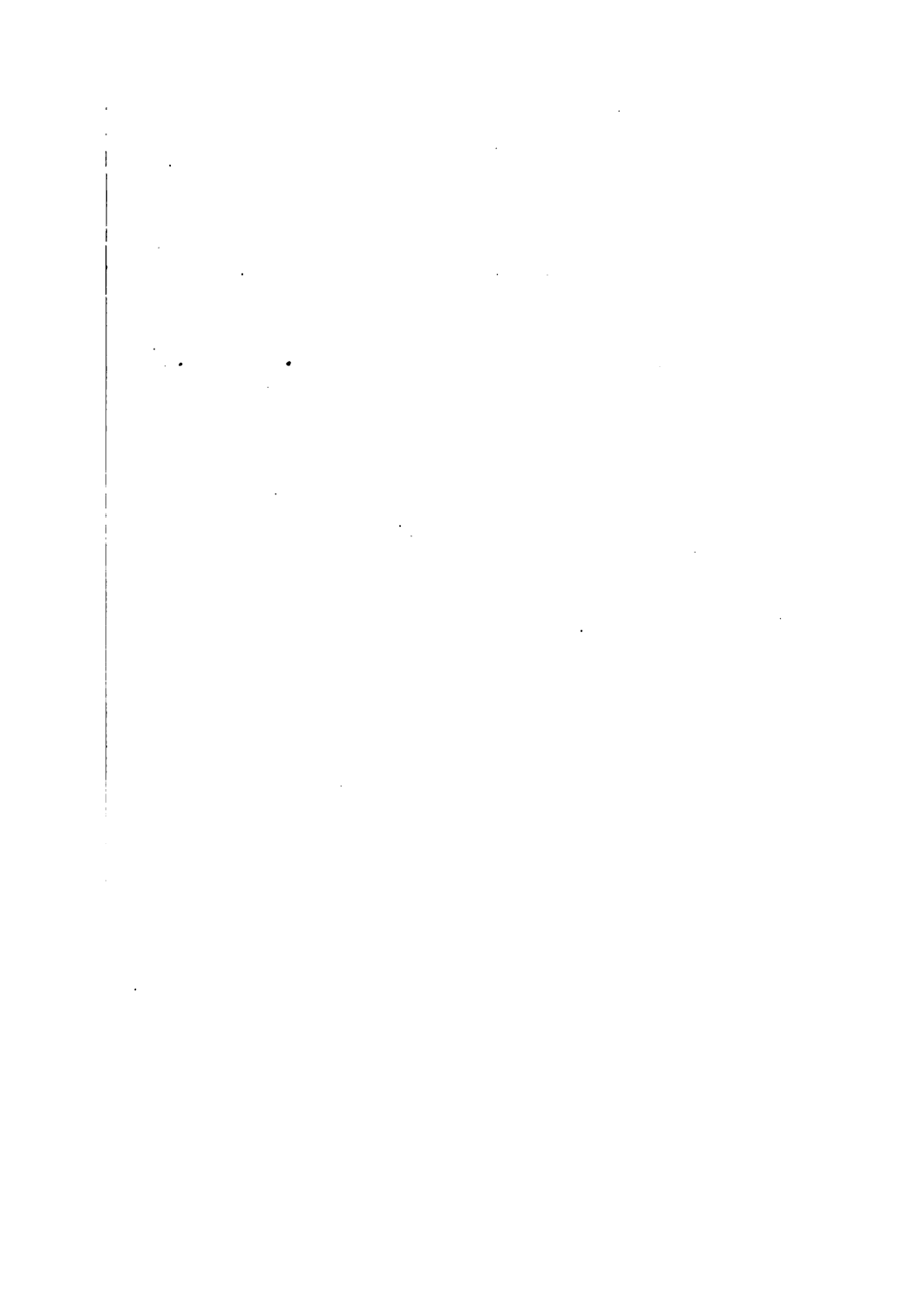
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LECTURES
ON
PULMONARY CONSUMPTION

LECTURE I

ON THE CONTAGIOUSNESS OF PULMONARY CONSUMPTION

GENTLEMEN,—Within the last few weeks, you have had an opportunity of seeing, in the Physiological Laboratory of King's College, specimens of certain micro-organisms, prepared by Koch of Berlin, and described by him as the bacillus of tubercle. This organism is believed by him to be the active agent in the origin and spread of tuberculous diseases. You have also had an opportunity of seeing that this micro-organism can be artificially cultivated and successive generations produced, each retaining with undiminished virulence the power of producing tubercle when introduced into the bodies of certain animals.

Now, this demonstration, which you have seen

with your own eyes, introduces you to problems in pathology and in practical medicine the importance of which it is impossible to exaggerate. Never, in the whole of the past history of medical science and of medical discovery, have propositions been advanced of greater import than those which have been advanced and maintained in connection with this discovery.

Let me state to you, in language as clear and simple as I can, what these propositions are.

1. Tubercle is an infective malady, originating in a specific virus, and propagated by the conveyance of that virus from body to body, and originating in no other way.

2. The specific virus of tubercle consists of a particular micro-organism, found only in tubercle; this organism can be seen in the cells of tubercle, can be obtained in a separate form, and cultivated in successive generations, without losing its original properties.

3. Certain forms of disease, termed "scrofulous," are essentially tuberculous; and their characteristic anatomical morbid products contain the infective organism peculiar to tubercle.

4. The disease known as pulmonary consumption is, in the main, a tuberculous disease, and is dependent on the presence and propagation

in the body of the infective organism characteristic of tubercle.

5. Pulmonary consumption is a contagious malady.

Of these five propositions, it is claimed for the three first that they rest on demonstration, as I propose to show you; the last two are, more or less, of the nature of inferences from the three preceding; and, in connection with these, we may expect to find there will exist some differences of opinion.

The idea that consumption is a contagious disease is not a new one. It is a doctrine which has always been maintained in the South of Europe—in Italy, Spain, and Portugal. Galen believed it, Morgagni believed it, and great names in the history of medicine, from their time to ours, may be found both for and against it.

Pidoux, in France, who had unusual opportunities of becoming acquainted with the histories of a large number of consumptives, declared that his own experience was directly opposed to this doctrine; and that he had never seen a single case of consumption that he could refer to contagion.

One of the most distinguished physicians of

our own times, formerly Professor of Medicine in this College, Sir Thomas Watson, in a course of lectures delivered in that very college where you have recently seen demonstrated the existence of a tubercle-bacillus, thus expresses himself on this subject.

“Is phthisis contagious? No; I verily believe not. A diathesis is not communicable from person to person. Neither can the disease be easily (if at all) generated in a sound constitution. Nor is it ever imparted, in my opinion, even by one scrofulous individual to another.”

From my own experience of consumption—and, as I shall show you presently, it has been a very large one—I cannot doubt that this was the judgment of sound common sense at the time it was uttered, and with such evidence as was then, and has been until quite recently, attainable. But it would be unscientific now to tie oneself to this opinion in the face of such facts as recent researches in experimental pathology have established.

On the other hand, another very eminent physician, a brother of another former Professor of Medicine in this College, Dr. William Budd, of Bristol, long ago promulgated the view that

pulmonary consumption was a disease "strictly analogous to the ordinary eruptive fevers in everything but the slowness of its progress; that, among European populations, tuberculous disease had undergone mitigation of its original severity by long prevalence; but he entertained no doubt of its eminently contagious character."

We must not be surprised that Dr. Budd's views met with little acceptance at the time. Insight, however penetrating, is not demonstration and scientific belief rests wholly on demonstration. Then (and even now), the evidence derived from practical experience against the contagiousness of consumption, in at all the same sense as smallpox and scarlet fever are contagious, seemed overwhelming; and, if we yield now to the teaching that phthisis is a contagious disease, we shall yield solely to demonstration and experiment. For such evidence as we obtain from the experience of physicians in their practice amongst consumptive patients affords, at most, but a weak presumption; and the facts I shall bring before you certainly show that consumption is by no means contagious in the sense which is ordinarily and popularly attached to that word. But the modern methods of experimental research are

doubtless destined to widen our conception of "contagion," as they have widened and corrected our conceptions in respect of many other pathological doctrines; and it is quite possible that, under certain given conditions, consumption may be a contagious disease.

During ten years of service in an institution devoted to the treatment of consumption, I saw over 27,000 persons who came to that institution for treatment, and a large proportion of that number were actually suffering from phthisis. Throughout this period, many problems naturally came into my mind as to the nature, the causes, and the treatment of this terrible malady; and, a few years ago, I endeavoured to obtain some data, from this extensive field of observation, as to the contagiousness or non-contagiousness of consumption. I followed the following train of reasoning: if consumption be a contagious or infectious malady, in the same sense and at all in the same degree as other maladies which are known to be contagious, the conveyance of the disease from husband to wife and from wife to husband, especially among the poorer classes in this country, ought to be a common and not a rare occurrence; for, amongst these classes, the husband and wife almost invariably occupy

the same bed, and live a life of close personal intimacy. The rooms they occupy are, more frequently than not, overcrowded, close and badly ventilated. In short, the external conditions amongst which consumption commonly appears amongst the working classes, are precisely those which would favour the dissemination of a contagious malady. If consumption in this country were, under ordinary conditions, a contagious malady, it would follow, so fatal as its course usually is, that in dealing with large numbers of consumptive patients taken from the poorer classes, we should often find, amongst the males, the survivors of wives who had died of phthisis; and, amongst the females, the widows of men who had succumbed to this malady. This fact must, I think, be clear to every one. So also we should expect to find husband and wife frequently the victims, together, of this disease. But this is comparatively rare.

For the purpose, then, of throwing some light on this question, I collected, a few years ago, the particulars of 1055 cases of consumption that had come under my case, consecutively, in the institution to which I have referred. Of this number, 621 were males and 434 females.

Of the 621 males, 306 were married, 297 were single, and only 18 were widowers; about 3 per cent. of the whole, and about 6 per cent. of those who had been married. Of the 18 widowers, two could only state positively that they had lost their wives by consumption, and one of their wives had been dead thirteen years; six of them had lost near relatives by consumption (father, mother, brother, or sister), giving a presumption in favour of hereditary predisposition, and in 10 no precise information could be obtained. Of the 434 females, 199 were married, 206 were single, and 29 were widows; the widows being about 7 per cent. of the whole, and about 15 per cent. of those who had been married. Of the 29 widows, 5 only were able to state positively that their husbands had died of consumption, 1 lost her husband "in a fit," 6 had lost near relatives (father, mother, brother, or sister) by phthisis, pointing to hereditary predispositions, and 17 could give no precise information.

At the same time that I was collecting these particulars from my out-patients, Mr J. Bartlett, at that time acting resident medical officer, was good enough to obtain the following particulars from those who were then in-patients. Of the

94 males in the hospital with phthisis, 53 were married, 37 were single, and 4 were widowers ; of these 4, 2 had lost their wives by consumption. Of the 53 whose wives were alive, all the wives except two were quite healthy. Of the 83 females who were then in the hospital with consumption, 62 were single, 15 married, and 6 widows ; of the 6 widows, 3 had lost their husbands by consumption ; in 2 of the 3 there was marked hereditary predisposition, and in 1 there was none ; in the remaining 9 cases the husbands were healthy.

Taking these figures for what they are worth, it seems certain that the communication of consumption from wife to husband, even among the class in which the conditions of life favour to the utmost the communication of contagious disease, is very rare ; while it would seem that communication (assuming, for the sake of argument, the disease really was communicated) from husband to wife is more frequent.

About the same time that I was making these observations, Dr Hermann Weber brought the subject of the communicability of consumption from husband to wife before the Clinical Society, and in his paper he states that he possesses the history of " 68 persons, male and

female, who, with a more or less pronounced consumptive taint, have married healthy partners. One or several of the partners of 10 out of these 68 cases became consumptive. The question, however," he says, "takes a different aspect if the originally tainted husbands and wives are considered separately. Of the 68 persons, 39 were husbands, 29 wives. Only one of the husbands of the 29 wives became diseased, while the wives of 9 out of the 39 husbands became affected. These 9 husbands lost 18 wives, viz. 1 lost 4 wives, 1 lost 3, 4 others lost 2 each, and 3 only 1 each.

One of Dr H. Weber's cases is certainly very remarkable. A young man, who had lost his mother, two brothers, and a sister of phthisis, and who himself had twice had hæmorrhage from the lungs, had quite recovered, and married at twenty-seven years of age, being then perfectly well. His first wife was in good health, and came of a healthy family. She died of consumption after her third confinement. The man shortly married again, an "apparently healthy woman," and this second wife, after a year of married life, died of "galloping consumption." He again married a third wife, a healthy young woman of twenty-

five, belonging to "an exceptionally healthy family." During her second pregnancy, she developed symptoms of phthisis, which ran a rapid course, and ended fatally in about eight months. Undaunted by his previous experience, this man, who seems to have had a mania for matrimony, married a fourth wife, a perfectly healthy young woman, twenty-three years of age, of healthy family antecedents. Three months after her first confinement, she too began to show symptoms of phthisis, and, notwithstanding two sea-voyages, died after an illness of nine months, with tubercle in liver, spleen, and intestines, as well as in the lungs. Though the husband of these four wives, who was a sailor, remained in apparently good health, physical examination revealed the existence of morbid changes about the apex of the left lung. It is possible that the life at sea kept his disease in abeyance; for, when he had to lie by on account of a severe fracture, the disease became active, and he died of consumption within two years.

I have called your attention to this case, because it is perhaps one of the most remarkable on record bearing on the communicability of consumption from husband to wife.

In Dr Weber's second case, three wives in succession of a consumptive husband died of phthisis, the husband ultimately dying of that disease himself. The disease in the wives appeared during pregnancy, or soon after delivery. The same story is repeated, with but little variation, except as to the number of wives, in Dr Weber's seven other cases quoted in his paper. Altogether, he had observed thirty-nine diseased husbands, and the wives of nine of them became consumptive after marriage; but, as several of the diseased husbands married repeatedly, it would appear that, out of fifty-one such marriages, eighteen wives became consumptive after marriage. As a set-off against this, out of twenty-nine marriages between consumptive wives and healthy husbands, only one husband became consumptive.

Another noteworthy observation of Dr Weber's was, that in the infected wives the disease manifested itself in an unusually active florid form, and ran an unusually rapid course; while in the husbands it was chronic, stationary, and apyretic. The fact of the onset of the disease following or occurring in connection with impregnation and utero-gestation, as well

as the fact of the immensely greater proportion of wives infected by husbands compared with that of husbands infected by wives, naturally provoked the suggestion that the latter became infected through impregnation and from the *fœtus in utero*, just as constitutional syphilis is conveyed from husband to wife. But there is another hypothesis equally tenable, and perhaps more in accordance with modern research; which is, that, during the puerperal state, the female constitution is peculiarly prone to the reception and cultivation of the germs of infective disease; and, assuming for the sake of argument that tubercle is propagated through the agency of an infective organism, the puerperal state may supply one of the conditions (such, for example, as we should conceive an increased body-temperature to supply) necessary for its cultivation and spread.

These valuable and striking observations of Dr Hermann Weber, while they give weighty support to the belief that consumption is, under certain circumstances, communicable from husband to wife, corroborate also the suggestions I have already made that, if phthisis be a contagious malady, it is so under very peculiar conditions and laws; that it is not contagious

in precisely the same sense as is ordinarily and popularly attached to that word.

I have said enough to show you that it would be extremely difficult to prove from clinical observations alone, or from experience, however extensive, of cases of consumption encountered in this country, that phthisis is an infective and contagious malady. Many, who have had the largest opportunities of judging, have formed an opinion altogether opposed to this view, and would regard Dr. H. Weber's experience as quite exceptional. And yet it seems very probable that consumption is in a sense contagious—contagious under certain conditions; and the practical question, at this moment especially urgent, is, "Under what conditions is consumption contagious?" But, before attempting to answer this question, it will be necessary to go back to the consideration of the remaining propositions which I formulated at the commencement of my lecture, and see on what kind of evidence they rest, and what is the exact relation of that evidence to the final proposition which forms the special subject of my lecture.

The first of these propositions was, that "tubercle is an infective malady, originating in

a specific virus, and propagated by the conveyance of that virus from body to body, and originating in no other way." It has taken many years to obtain for this proposition anything like general acceptance amongst pathologists and physicians, and even now there are not a few who hesitate to accept this doctrine. It is some years ago (1865) since Villemin published the results of a series of methodical experiments, which he had undertaken for the purpose of showing that tubercle was an infective malady. His method was to take a small portion of tuberculous matter, as big as a pin's head, from the body of a man, a dog, cow, or a rabbit, and introduce it under the skin of the ear, the groin, or the axilla, in rabbits and dogs. He found that the wound at first healed over; but, after four or five days, the seat of the inoculation began to be red and swollen, and a tuberculous mass became developed there causing an ulcerated wound. If these animals were killed after the fifteenth day from the inoculation, tubercles were always found in the viscera; in the lungs, they were usually abundant; grey granulations, as well as extensive infiltrated masses of tubercle, more advanced according to the length of time that had elapsed

since the inoculation, and cavities, were sometimes found ; while at the seat of inoculation a caseous mass was usually found, surrounded by small yellowish granulations. The corresponding lymphatic glands were enlarged, and often contained scattered nodules of tubercle, some having undergone caseous degeneration. Cats and guinea-pigs were readily inoculated ; but sheep, goats, and birds escaped infection. He obtained the same results from injecting hypodermically the sputa of phthisical patients in very small quantities, mixed with water. Blood taken during the life of animals with phthisis gave negative results ; but, taken after death from phthisical men, it readily produced general tuberculosis in rabbits.

Chauveau, of Lyons, corroborated Villemin's results, by means of experiments on oxen, animals disposed to tuberculosis. He gave to oxen, by the stomach, tuberculous matter obtained from the human subject or from other oxen, and they all became tuberculous, the lesions varying from trivial ones to the gravest possible. Typical tubercle granulations were found in the lungs, as well as caseous masses in all stages. The same results followed inoculation into the connective tissue, and in-

jection into the veins of water holding in suspension tuberculous matter after filtration.

Other experimenters (including Drs Burdon Sanderson and Wilson Fox, in this country) soon opposed other views to those of Villemin and Chauveau. They stated that, in order to produce tuberculosis in rabbits and guinea-pigs, it was not at all necessary to inoculate these animals with tuberculous matter; that they might be rendered tuberculous by other means. They stated that, in the guinea-pig and some other animals, tuberculosis might be produced by inoculations with pus, or with caseous matter of inflammatory origin, or with sarcoma, just as well as with tubercle; that, in the guinea-pig, tuberculosis had been produced by the application of a simple seton; and that, in the rabbit, deep wounds, without inoculations of any sort, would produce pulmonary tuberculosis. Wilson Fox, in his experiments on guinea-pigs, introduced under the skin various substances—portions of putrefied muscle, fatty liver, and even vaccine virus, with the same result; and it was maintained by others that such substances as aniline blue, cinnabar, caoutchouc, cotton, &c., caused similar effects; and that carnivorous animals might be fed long on

tuberculous lungs without the production of tuberculosis.

Then, it was said by others that the lesions produced by Villemin were not tubercle at all, but simply inflammatory lesions or embolic infarcts; and some went so far as to say it was impossible to produce tuberculosis experimentally. At the same time, Chauveau, Klebs, and Böllinger, maintained the correctness of the experiments and views of Villemin.

Two physicians mentioned in the 'Nouveau Dictionnaire de Médecine et de Chirurgie' (Art. "Phthisis"), went so far as to inoculate themselves with the serum of a blister applied to a phthisical patient, and we are not surprised to hear, without effect: for, if the peculiar micro-organisms which we have recently seen be the active agent in the production of tubercle, we should scarcely expect to find it in the serum extracted from the blood by the action of a blister. Another remarkable case of human inoculation is mentioned in the work I have just cited. Three medical men of Syra (in Greece), in 1874, inoculated a man, fifty-five years of age, with tubercle. He was suffering from gangrene of the left great toe, due to obliteration of the femoral artery, and was in a mori-

bund state. They inoculated some of the sputa of a phthisical patient into the upper part of the right leg. The lungs were previously examined with great care, and found to be perfectly sound. Three weeks later there were signs of commencing induration at the right apex. On the thirty-eighth day after the inoculation the patient died of gangrene. At the necropsy, there were found, at the apex of the right lung, seventeen small tubercles, varying in size from that of a mustard seed to that of a lentil. Two similar tubercles were found at the left apex—two others on the convex surface of the liver. The authors of the experiment considered the embryonic state of the tubercles, and their limited number, to correspond with the short space of time that had elapsed from the inoculation.

It is not likely that an experiment of this kind will be often repeated; but though it stands alone, it is none the less an important observation.

Tappeiner and others have shown that animals could be rendered tuberculous if tuberculous matter (such as the sputa of phthisical patients) were diffused in spray in the air which they breathe.

It has also been stated by Professor Gerlach that, in the variety of tubercular disease which affects oxen, the infection can be introduced by the stomach, if portions of the tubercular organs be mixed with the food, or if the healthy animal be fed with milk from the animal which has tubercle (Simon, 'Proceedings of International Congress'). Now, as tubercle is a malady which is very common among cows, this observation is one which may have a vast importance in connection with the feeding of young children.

Cohnheim has also made numerous observations on the infective nature of tubercle. He introduces the tuberculous matters either into the subcutaneous tissue or into the pleural or peritoneal cavity, or into the anterior chamber of the eye. After introduction in the latter situation, the primary irritation soon passes away, the small piece of tuberculous matter becomes smaller and smaller, and may even wholly disappear; for a time the eye appears quite clear and intact, when suddenly in the iris a number of delicate grey nodules appear, grow to a certain size, and then caseate. In rabbits and guinea-pigs, fourteen days after the introduction of the virus, disseminated

tuberculosis will appear in the various organs ; in other animals, twenty-one days is the usual period of incubation. He has succeeded with pieces of lung affected with caseating pneumonia, or with pieces of caseating testicle, or with freshly excised scrofulous gland from the neck ; but he has never found any result from introducing caseated sarcoma or myoma, or simple lymphoma.

But some of the most instructive and conclusive observations and experiments on this head are those of Dr Hippolyte Martin, of Paris. They are related in an article on the "Relations between Tuberculosis and Scrofula," in the '*Revue de Médecine*' for April of this year ; and also in the '*Archives de Physiologie*' for 1881, on the "Infective Properties of Tubercle." The object of his original experiments was to show that inoculation with true tuberculous matter was alone capable of producing true, general tuberculosis, and that all the lesions produced by the introduction of foreign bodies of non-tuberculous nature were not true tubercle, but what he terms false or "pseudo-tubercle." But he insists that it is of prime importance that all these inoculations should be performed with strict antiseptic

precautions ; and that if, perchance, the inoculation of non-tuberculous foreign substances have been followed by an eruption of true tubercle, it is because these precautions have been disregarded. He also points out that the anatomical structure of the true and false tubercle, as revealed by microscopical examination, is identical, and that the only means of distinguishing between them is by inoculation in series—by a series of successive inoculations.

True, infective tubercle is reproduced in an indefinite series, producing always a general tuberculosis as a consequence of local infection, the infectious properties becoming, if anything, more energetic as the series is prolonged. The same method proves the absolute innocuousness of false (pseudo) tubercle.

Some of his experiments are so important that I make no apology for citing them to you. First, Dr. Martin tested the effects of injecting irritating animal and vegetable powders, such as cantharides, lycopodium, and pepper, into the peritoneal cavity of guinea-pigs. In one instance he injected sixty centigrammes of lycopodium diffused in water into the peritoneal cavity of a guinea-pig ; the animal died four months afterwards of general adhesive perito-

nititis, but all the viscera were healthy. Into the peritoneum of another guinea-pig he injected a large quantity of powdered cantharides mixed with water; nine months after the injection the animal was quite well.

His next experiments were with fragments of morbid growths, non-tuberculous. Four pieces, of a cubic centimètre each, were cut from an epithelial tumour freshly removed from the neck of the uterus; two pieces were placed in alcohol, and two pieces in bichromate of ammonia. After a week the two preserved in alcohol were introduced into the peritoneum of an adult rabbit, and rather more than three months afterwards the animal was killed; both fragments were found encysted in different parts of the peritoneal cavity; all the viscera were healthy. The two other fragments were introduced into the peritoneum of another rabbit, and about a month later the animal was killed, and the fragments were found enveloped in a fold of omentum, their angles rounded, and absorption evidently commenced. All the viscera were healthy.

In another experiment, two pieces of a sarcoma of the testicle, freshly removed, were immediately introduced into the peritoneal

cavity of a guinea-pig; about a month later the animal was killed, and no trace of the foreign bodies was to be found, and all the viscera were perfectly healthy. The same experiment was repeated with portions of mammary carcinoma, on a large and strong female guinea-pig in a state of advanced utero-gestation. She was confined with two healthy little ones a few days after, and, when killed two months afterwards, two free masses were found in a cyst in the abdomen, wholly caseous, and dry like crude tubercle. All the viscera were healthy.

The same kind of results followed the introduction in the same manner of a piece of the femur of a rabbit, with periosteum and some fragments of muscles adherent; half the tibia of a new-born infant that died of erysipelas; three squares of a hard pear; two squares cut out of a ripe apple. In one of these cases, about six weeks after the operation, the two pieces were found surrounded by yellow pus in a large vascular cyst. There was no peritonitis; the viscera were healthy.

The next experiment is very significant. In the centre of a large sarcoma removed from the thigh of an infant there was a large completely

caseous nodule ; a portion of this caseous matter, weighing 50 centigrammes, was introduced into the peritoneal cavity of a rabbit, with careful antiseptic precautions. A year afterwards the animal was in perfect health.

These experiments prove conclusively that those observers were certainly in error who asserted that almost any kind of foreign body—animal or vegetable—would produce tuberculosis in guinea-pigs.

In other experiments, Dr Martin has shown that foreign bodies having irritant properties, non-specific, may set up inflammation, the pathological products of which may have a complete anatomical resemblance to true tubercle, no distinction being possible by microscopical examination ; and he has obtained by means of cayenne pepper, lycopodium, and cantharides, the finest specimens of pseudo-tubercle ; but these lesions, in spite of their special anatomical structure, have no specific virulence. He had repeatedly injected, with antiseptic precautions, the caseated inflammatory products of such experiments, and always failed to produce an eruption of tubercle. He insists strongly on the necessity, especially in a pathological laboratory, of these antiseptic precautions. All the

instruments should be washed in alcohol and heated in a flame ; and before each operation all parts of the syringe should be taken to pieces and treated in the same way.

On the other hand, pus from a scrofulous gland in the neck, as well as scrofulous products not yet degenerated, not caseous, inoculated immediately after surgical removal, produced a series of cases of generalised tuberculosis.

Dr Martin's experiments completely establish the following conclusions :—1. Tubercle, inoculated locally, determines, after incubation, the formation of a local tubercle, and, after a variable time, general tuberculosis ; and the virus seems to acquire increased activity by inoculation in series of animals of the same or allied species. 2. But if we inoculate matter obtained from those tubercles secondary to the injection of non-tubercular foreign bodies, they never give rise to general tuberculosis ; and, after two, or, at most, three terms of the series, they even lose the power of producing a local inflammation and become absolutely inoffensive.

Here, then, he remarks, we have two inflammations ; one specific, infective, and truly tuberculous ; the other non-specific, non-infec-

tive, and not true tubercle ; but both having the same anatomical structure, and the former differing from the latter by the presence of the properties of a morbid agent at the present time unknown. It is this "unknown morbid agent" which Koch believes he has made known to us and shown us—an agent which the microscope had failed to discover until those special methods of preparations were employed which Koch has had the honour of discovering.

So, then, the proof of our first proposition seems complete ; that "tubercle is an infective malady, originating in a specific virus, and propagated by the conveyance of that virus from body to body, and originating in no other way." And Koch's experiments appear to have proved the truth of the second proposition, that this "virus" is the property of a micro-organism peculiar to tubercle, and which may be called the tubercle-bacillus.

I need not repeat what has already been published as to Koch's methods of investigation. I may, however, say that the tubercle-bacilli appear as "delicate rods from a quarter to half the diameter of a blood-corpuscle in length" ; that they have been found "in large numbers

in all places where the tubercles are of recent formation and spreading rapidly; more especially at the border of the cheesy masses." They possess a special relation to the giant-cells, being found in their interior sometimes to the number of twenty in each cell. They do not appear to possess any power of movement. In some of the rods oval spores have been seen. They have been seen in the human subject in cases of miliary tuberculosis, in cases of caseous broncho-pneumonia, in tubercle of the brain, in intestinal tuberculosis, in freshly extirpated scrofulous glands, and in certain cases of synovial degeneration of joints. Nor need I repeat the account of the beautiful series of experiments by which Koch has shown that it is to the presence of this organism, and to this alone, that tubercle owes its infective property. One fact, however, let me mark, *en passant*, for future comment. "It was found that these bacilli required a temperature approaching that of the human body for their growth." The minimum temperature of 86° Fahr., and the maximum of 104°, are the limits between which they can develop and multiply. This disposes of the first and second propositions, and brings us to the third; viz. "that certain forms of

disease termed scrofulous are essentially tuberculous.

Both the experiments of Koch, as well as those of Dr Hippolyte Martin, go to establish this proposition. I have just said that Koch has found the infective bacillus of tubercle in freshly extirpated scrofulous glands, and in certain cases of (scrofulous) degeneration of the synovial membrane of joints. And Dr. Martin has obtained a series of cases of generalised tuberculosis by successive inoculations in guinea-pigs; the original inoculations being in one instance from a small collection of pus found, after death, in a firmly encased sub-maxillary gland of a child, who had died of measles and broncho-pneumonia without any trace of tubercular disease, but with well-marked clinical characters of scrofula; and in another, from non-degenerated (non-caseous) scrofulous products, a few instants after surgical removal.

Dr. Martin suggests, however—and the suggestion seems to me a sound and practical one—that scrofula is, perhaps, not a distinct morbid type, and that some of its manifestation must be included under the class of tuberculous diseases, and that others belong simply to the

"lymphatic constitution"; that the possession or non-possession of the property of infection, capable of being transmitted through a series of inoculations, affords the only elements of a certain diagnosis, or, as Koch would probably say, the presence, in their characteristic anatomical elements, of the tubercle bacillus.

The fourth proposition, that pulmonary consumption is, in the main, a tuberculous disease, will no doubt be stoutly opposed by many in this country who have adopted those views of the origin of pulmonary consumption in ordinary inflammatory processes which have been so ably advocated by Niemeyer; and much additional experimental research will be necessary in order to set this question at rest.

At present, this proposition rests on the observation that fresh caseous matter, as well as the grey granulations found in the lungs of phthisical patients, are infective, and contain in their anatomical elements the tubercle-bacillus, and that the sputa of phthisical patients are infective; whereas the caseous degenerated products of ordinary inflammation are not infective (in series), and do not contain the characteristic micro-organism.

But it is not denied that chronic inflammatory

changes may be produced in the lungs by the entrance of various irritating foreign particles, and that these changes may in time produce fatal injury to the organs of respiration; it is, however, suggested that these cases should not be spoken of as phthisis, but as forms of chronic pneumonia.

In conclusion, we again come to the fifth and last proposition, the proposition with which we started, that pulmonary consumption is a contagious malady. I must again say that it is impossible to over-estimate the importance of establishing the truth or error of this proposition.

It is precisely one of those questions upon which the Collective Investigation Committee of the British Medical Association may be expected to gather up valuable information. And it is one also which can scarcely be cleared up without prolonged and repeated investigations by means of experiments on animals; not painful experiments, happily; there is no need to give pain in carrying out the kind of investigations which this subject demands, and which are calculated to promote the welfare of both man and animals. There are, moreover, many matters of daily concern connected with this

investigation ; the way, for instance, in which consumptive patients should be tended and nursed ; the propriety of massing together a great number of consumptive patients in the same building ; the propriety of allowing healthy persons to breathe air contaminated by the breath of such patients ; the mode of dealing with their expectorations ; the kind of medical, climatic, or other treatment best suited to the arrest and cure of the disease regarded as an infective malady ; the marriage of consumptive patients. Supposing consumption to be, under certain conditions, a contagious malady, there seems to be, *primâ facie*, some ground for believing that one of those conditions may be that of temperature—the temperature of the body, or the temperature of the external air.

I have already mentioned that in the South of Europe consumption has always been looked upon as a contagious disease. May this not be owing to the relatively higher temperature of these regions ? And we naturally associate with this reflection Koch's statement that the tubercle-bacillus requires a temperature above 86° Fahr. for its propagation.

I must content myself at present with simply

pointing to this question of the influence of temperature upon the origin and propagation of consumption, as one which requires careful investigation. I shall have something to say in a future lecture on the antiseptic treatment of consumption. Finally, there is the pressing question of the possibility of conveying tuberculous disease to children by feeding them with the milk of consumptive cows ; but I have said enough I hope to convince you of the truth of the statement I made at the commencement of this lecture, that it is impossible to exaggerate the importance of the subject to which I have now called your attention.

APPENDIX

As being of interest in connection with the subject of the preceding lecture, I append the following memorandum by the late Dr William Budd, of Clifton, published in the 'Lancet' of October 12th, 1867, and introduced by a note from Dr Paget, of Cambridge.

Memorandum on the Nature and the Mode of Propagation of Phthisis, by William Budd, M.D., Consulting Physician to the Bristol Royal Infirmary.

"He that would follow philosophy must be a freeman in mind."—*Ptolemy*.

(NOTE FROM DR PAGET)

To the Editor of the 'Lancet'

SIR,—The paper I send enclosed was received by me last December, in a sealed packet, from Dr Wm. Budd, of Clifton, with a request that I would take charge of it until he should direct me to break the seal. At his desire I opened the packet a few days ago, and I now send you the contents, requesting the favour of their early publication in the 'Lancet.' They are an epitome of what Dr W. Budd has been for some time intending to publish in a more complete form; but his intention has been frustrated, and is still delayed, by the requirements of professional practice and other circumstances beyond his control.

You will at once perceive the originality of his views, and their very high importance, if established. If the evidence now given of their truth be incomplete, it is at least abundantly sufficient to raise them out of the region of mere hypothesis, and ensure their careful consideration by pathologists.

* * * * *

I am, &c.,

G. E. PAGET.

Cambridge, September 30th, 1867.

The following are the principal conclusions to which I have been led regarding phthisis or tubercle:

1. That tubercle is a true zymotic disease of specific nature, in the same sense as typhoid fever, scarlet fever, typhus, syphilis, &c., are.

2. That, like these diseases, tubercle never originates spontaneously, but is perpetuated solely by the law of continuous succession.

3. That the tuberculous matter itself is (or includes) the specific morbid matter of the disease, and constitutes the material by which phthisis is propagated from one person to another and disseminated through society.

4. That the deposits of this matter are, therefore, of the nature of an eruption, and bear the same relation to the disease phthisis as the "yellow matter" of typhoid fever, for instance, bears to typhoid fever.

5. That by the destruction of this matter in its issue from the body, by means of proper chemicals or otherwise, seconded by good sanitary conditions, there is reason to hope that we may eventually, and possibly at no very distant time, rid ourselves entirely of this fatal scourge. The evidence on which these conclusions are founded is drawn from the following principal sources :

(a) Considerations based on the pathology of phthisis, as showing it to consist in the evolution and multiplication within the organism of a specific morbid matter, with a universal tendency to elimination and casting forth of the same, after the type of zymotic diseases generally.

(b) Actual instances in which there was evidence to show that phthisis was communicated from one person to another.

(c) The geographical distribution of phthisis in past and present times, and especially its great fatality now in countries which, when first discovered by Europeans, were known to be entirely free from it.

(d) Its much greater prevalence in low levels and among crowded communities, and its entire absence, unless by casual importations, at very high levels, conditions which are well known to rule, in the same directions, the spread of zymotic diseases generally, and especially of that group in which, as in phthisis, the morbid matter is cast off in a liquid form.

(e) Its very high rate of prevalence in convents, harems, barracks, penitentiaries, &c., that is to say, under the very social conditions which are known most to favour the propagation of diseases of the zymotic group.

Among the data relating to geographical distribution the following striking facts may be here mentioned :

1. When the South Sea Islands were first discovered

phthisis did nor exist there. Since the aborigines have come into intimate contact with Europeans the disease has not only made its appearance among them, but has become so widespread as to threaten their extermination.

The contrast between original entire immunity and present extreme fatality is very striking, and can only be rationally explained by the importation of a *new and specific morbid germ*.

Try every other supposition and the facts are inexplicable; make this one supposition and they are at once explained.

2. The late Dr Rush, of Philadelphia, who made very accurate inquiries to determine this point, satisfied himself that when America was first discovered phthisis was unknown among the native American Indians. Now it is very fatal to them.

The very significant contrast here exhibited between the past and present history of these two races in respect of phthisis is exhibited at once, and at the present time, among the negro race in Africa in different parts of the area of that great continent.

It is well known that negroes are peculiarly liable to phthisis.

Now, everywhere along the African seaboard, where the blacks have come into constant and intimate relations with the whites, phthisis causes a large mortality among them. In the interior, where intercourse with the whites has been limited to casual contact with a few travellers or other adventurous visitors, there is reason to believe that phthisis does not exist. Dr Livingstone and other African travellers have given me the most positive assurances on this point.

The idea that phthisis is a self-propagated zymotic disease, and that all the leading phenomena of its distribution may be explained by supposing that it is disseminated through society by specific germs contained in the tuberculous matter cast off by persons already suffering from the disease, first

came into my mind unbidden, so to speak, while I was walking on the Observatory Hill at Clifton in the second week of August, 1856. The close analogy, in many quite fundamental points between this disease and typhoid fever had often impressed itself on me with very great force while I was engaged in the study of the latter, and in the preparation of the papers I have published on it. I now saw with a clearness which had never occurred to me before that, with the exception of the qualifications necessary for their application to a chronic disease—for the most part of slow evolution and widespread duration—the leading conclusions to which I had been led respecting the propagation of fever might be applied with the same strictness to phthisis also. This idea had no sooner taken possession of my mind than considerations of great force and in overwhelming numbers crowded upon me in illustration of it. In the course of the same evening I drew up some notes on the subject, and before the end of the month my views upon it had taken, in outline, the exact shape which they now have.

The long interval which has occurred between the summer of 1856 and the present date has been occupied in collecting data bearing on the various questions raised by the new theory—in accumulating evidence of various kinds, and in examining and carefully weighing difficulties. During the whole of this long time the subject has scarcely ever been absent from my mind. The result has been only to confirm me more and more in the truth of my first conclusions. I earnestly hope that they will not be lightly rejected. At any rate, I can say that they have not been brought forward in haste or without due deliberation. I have, in fact, considerably exceeded the ten years which, with a fine sense of what is due to such an enterprise, the Roman poet prescribed as the time to be given to every composition intended by the writer to endure.

Many causes have helped to prevent me from giving my views on this subject sooner to the world. Chief among

them I may name want of time to put them into that scientific form and clear logical order, under which alone an innovation so daring has any chance of being entertained, much more of being accepted, by the profession. This task however, I hope to complete in the course of a few months; meanwhile I have thought it well to place this memorandum, by way of record, in the hands of a friend, to be made public at any moment should occasion seem to require it.

Manor House, Clifton, December 1st, 1866.

NOTE I

VIEWS OF PROF. RINDFLEISCH

In juxtaposition with the views expressed in 1867 by Dr. William Budd, it is interesting to place the lately-expressed views of Professor Rindfleisch.

Professor Rindfleisch ('Archiv für Path. Anat. und Phys.,' t. lxxxv, p. 71) has recently stated his belief that tuberculosis is an eminently infectious malady, that it is readily transmitted by inoculation from man to animals, and that the reason there are so few facts in support of its transmissibility from man to man is because the human species has become, to a certain point, acclimatised to the disease. Originally tuberculosis must have been a disease analogous to what syphilis is at present. It possessed, and still possesses, the property of hereditary transmission. With the lapse of time the poison has become, as it were, a common heritage to all the successive generations, which, on that account, have acquired a certain immunity against infection from without. On the other hand, as soon as the general physiological state of health becomes lowered tuberculosis manifests itself afresh.

NOTE II

INFLUENCE OF TEMPERATURE ON DEVELOPMENT OF
INFECTIVE ORGANISMS

The influence of temperature on the development of infective organisms and on the propagation of infectious diseases, to which I have alluded in the foregoing lecture, has received some important elucidations by the experiments of M. Gibier.

M. Pasteur had proved that the microbe of charbon could not be developed in fowls on account of their relatively high temperature (109° — 111° F.), the virus of charbon losing much of its activity at a temperature of more than 100° ; but when M. Pasteur cooled the fowls by plunging their feet in cold water, he found he could communicate this disease to them. M. Gibier has made the counterpart of this experiment. He has taken a cold-blooded animal—the frog—and has raised its temperature until it attained the degree at which the microbe is susceptible of development. Liquids infected with the virus of charbon were injected subcutaneously into frogs, and at their ordinary temperature no results followed. But when, by plunging them in warm water, he raised their temperature to 98° F., then he found the virus infected the frogs and a certain number of them died. A very curious circumstance was noticed in connection with these experiments, viz. that the frogs which had been inoculated *cold* without result were unaffected by the second inoculation after warming! This may have been only a coincidence, or it may have been that they were protected by the first inoculation.

He also found that the bacterium of charbon, when developed in the blood of frogs, was much longer than those in warm-blooded animals, and he suggests that the cause of this is the slowness of circulation in these animals: that in warm-blooded animals the more rapid currents break the small rods or hinder their development.

NOTE III

M. GIBOUX'S EXPERIMENTS

In connection with the discussion as to the communicability of phthisis, M. Giboux in 1878, and again quite recently, reported to the French *Académie des Sciences* experiments which he had made on the noxious properties of the air expired by phthisical patients, his later experiments corroborating those he had formerly reported. His method of procedure was as follows:—He obtained daily forty to fifty litres of air expired by patients in the second and third stages of pulmonary consumption. Half of this he passed daily into a cage which contained two rabbits born of healthy parents, as ascertained by post-mortem examination. Two other rabbits of the same litter were kept in an absolutely similar cage, and through this cage the other half of the contaminated air was passed *after having been filtered* through cotton wool impregnated with carbolic acid. The two couples were kept in separate rooms.

The experiment was maintained from the 15th of January to the 20th of April, at the end of which time the two rabbits in the second box were in a state of perfect health; those, on the contrary, in the other box, began to lose appetite, to be very thirsty, to suffer from diarrhoea and emaciation; and at the autopsy tubercles were found in the principal viscera, the pulmonary lesions being far more advanced than the others. The rabbits in the other cage, when killed and examined, showed organs in perfect health.

It does not, of course, follow that the same air would be as hurtful to men as to rabbits, but the reporter, in the '*Gazette Médicale*' of Paris, mentions two instances which came under his own observation of persons in perfect health, with no hereditary taint, who contracted a rapidly fatal form of tuberculosis after living in close intimacy with consumptive persons. In these cases the tuberculae were most marked

in the lungs, and in one case the fatal event was hastened by œdema of the glottis.

NOTE IV

ON THE METHOD OF EXAMINING FOR THE BACILLUS
OF TUBERCLE

Dr Ehrlich has devised a mode of preparation, recently modified by Professor Rindfleisch, of Würzburg, by which the presence of the bacillus of tubercle is more easily detected than by any other hitherto made known. In doubtful cases, this mode of preparation may serve as a valuable agent in diagnosis. In treating the sputum of phthisical patients, or the matter resulting from scraping a tubercle, the thin layer necessary for examination is obtained by placing a small quantity of the matter between two cover-glasses, which are gently pressed together, and easily separated by sliding one over the other. The cover-glasses are then gently heated during a few seconds over a gas-flame, or, what is preferable, they are placed in a stove heated at 100° Cent. (212° Fahr.), for the purpose of coagulating the albumen. Afterwards, they are placed in an alkaline solution of fuchsine (the fuchsine used is only soluble in alcohol), or in violet methylaniline prepared as follows:—A mixture of five parts of oil of paraffine and four parts of distilled water is well shaken for some time; then filtered through a damp paper. The filtering gives several cubic centimètres of liquid, to which are added some drops of concentrated solution of aniline. This alkaline solution and the cover-glasses are placed in a cup with a glass cover. The cup, with its contents, is kept half an hour in a stove heated to 40° Cent. (104° Fahr.). The next step is to let the mixture drain off the cover-glasses by gently shaking them. They are then washed in water containing 2 to 3 per cent. of nitric acid, and afterwards in distilled water. The preparation is then mounted in gum dissolved in glycerine,

to which is added a small quantity of arsenious acid to prevent the development of fungi, or carefully dried in ordinary Canada balsam, and examined with the Abey illuminating apparatus and homogeneous immersion. Sections of tubercle hardened only in alcohol are treated in the same way, with the necessary modifications.—*Brit. Med. Journ.*, July 22nd, 1882. •

LECTURE II

ON THE ANTISEPTIC TREATMENT OF PULMONARY CONSUMPTION

GENTLEMEN,—It is but a short step from the consideration of the “contagiousness of consumption” and the infective quality of tuberculosis, concerning which I last addressed you, to the question of the antiseptic treatment of that disease.

If the expectoration, if the matters discharged from the air-passages of a phthisical patient, swarm with infective micro-organisms, as we are assured on the highest authority is the case, if the active invading area of the diseased portion of the lung be also crowded with these same infective bacilli, what treatment can be more rational and more appropriate than that which aims at destroying the life and activity of these organisms? indeed, I might ask, what treatment can be rational or appropriate which neglects to follow this indication? The only

edly prescribed the inhalation of antiseptic vapours in cases of phthisis, as well as other treatment which I have believed to be also antiseptic; and you must often have noticed, in the wards of this hospital, that all my phthisical patients have been in the habit of wearing a form of respirator-inhaler for the purpose of inhaling antiseptic vapours, which I shall immediately describe to you.

In a paper on "Recent Researches in the Treatment of Phthisis," which I contributed to the annual meeting of the British Medical Association in 1876, I called attention to the progress that had been made in the direction of the antiseptic treatment of this malady, and I described several methods of applying this form of treatment; and, since then, several physicians, who have had large opportunities of testing its usefulness, have published some very successful results as following this plan of treatment.

Moreover, it would not be difficult to trace an antiseptic action (assuming phthisis to be dependent on the presence of an infective organism in the lungs) in some of the remedial measures of greatest repute in the treatment of this disease. The beneficial effects which

are reported from the employment of the sulphurous waters of Eaux Bonnes (Dr Leudet, 'Les Eaux Bonnes dans le Traitement de la Phthisie Pulmonaire'), and of Caunterets, and of the so-called "arsenical" waters of Mont Dore, may they not be due to an antiseptic action? for the explanations of their mode of action hitherto put forth are eminently unsatisfactory. For example, when it is suggested that the sulphurous springs of Eaux Bonnes cure phthisis by "the formation or arousing of constitutional maladies of a slighter kind, which act as antagonists to the graver disease," we must feel that we are not very far off from such dogmas as the *similia similibus* of the homœopaths. But, even supposing we are on the right track in applying an antiseptic method of treatment to phthisis, and in assuming a unity and identity of origin in the great majority of cases which are recognised as pulmonary consumption, we must not ask more of this method or expect better results from it than it can possibly give.

Nothing can be more certain than that tuberculous disease, whatever may be its intimate nature, tends invariably to be complicated with the products of inflammation. Wherever

there is tubercular disease present in the lung, there you will find the results of present or past inflammatory action. The course and aspects of pulmonary tuberculosis are so uniformly overclouded with the phenomena of inflammatory action that some of this "cloud" seems to have settled down over the minds of many pathologists; and, in regarding phthisis, they seem to be unable to see through this mist of inflammation; and it must be admitted, if these micro-organisms cause destruction of lung-tissue, they do so by exciting a peculiarly destructive form of inflammation; so that, in the treatment of phthisis, you must never lose sight of this inflammatory process, which always accompanies it, and plays a predominating part in its manifestations.

If in phthisis, as seems most probable, we have to do primarily with a specific virus or infective organism, and secondarily with an inflammatory process excited by it, our treatment must have a twofold object—the destruction of the virulent agent and the reduction of the accompanying inflammation; and, in actual practice, my own experience certainly shows that the best results follow the combination in treatment of these two ends.

If we look through the whole of the literature dealing with the treatment of phthisis, it seems to me that two facts start out in remarkable prominence: one is the value of treatment which may be regarded as antiseptic—sea-voyages, mountain air, dry pure air in any locality, sulphur waters, terebinthinate vapours, iodised vapours, &c.; and the other is the value of counter-irritation, systematic and continued counter-irritation; treatment, you see, directed against a virus or an infective property—treatment directed against the results of present and past inflammatory action. But we must not expect more from antiseptic treatment than it can possibly yield. I have seen it remarked that cases of phthisis, though they might be benefited, are not cured, by antiseptic treatment. To this I would reply, that aseptic and antiseptic treatment, if they do not cure, are, at any rate, an essential condition of cure where cure is possible. Nature often herself erects an antiseptic barrier against the invasion of septic agents. And one of the most universally admitted remedies for staying the progress of phthisis is the removal of the patient to some place where he shall breathe an aseptic, if not an antiseptic, atmosphere. It

is foolish to expect that antiseptic agents can act, so to speak, retrospectively. Water may extinguish fire and stay its ravages, but it cannot rebuild what the fire has destroyed. So antiseptic agents may arrest the activity of septic influences, but they cannot undo the mischief that is already done.

When I read of hospital physicians vigorously plying, with so-called antiseptic sprays, patients in the very last stages of phthisis, with lungs riddled with cavities, and then reporting that they have arrived at "decisive negative results," I am amazed to think that they ever imagined it possible that they could arrive at any other.

When I read that such a plan of treatment was attempted in nine patients during the last three weeks of their lives, and then read that after death "nothing was found in the pathological condition of the lungs which in any way indicated the commencement of a healing process; there was an extensive phthisical decay, with cavities filled with fluid pus; in one case of left-sided pneumothorax there was a perforated cavern—" I feel constrained to say, that if ignorant charlatans wrote in this way, we should find no language too severe to con-

demn their imbecility. Gentlemen, this kind of thing is foolish trifling. When you are called to a case, as it is often my lot to be, and find a patient in the last stage of phthisis, with physical evidence of extensive phthysical infiltration and breaking-down of large tracts of lung-tissue and signs of excavation in various parts of both lungs, you should honestly confess that you are absolutely powerless before such a state of things, and never bring discredit on any method of treatment by attempting with it what, from your experience and pathological knowledge, you must be aware is absolutely impossible.

Nor should we fall into the error, as some writers seem to have done, of regarding the antiseptic treatment of pulmonary phthisis as closely analogous, or a strict parallel, to the antiseptic method as adopted in surgical procedures.

The surgeon's object is to prevent the access of infective organisms from without; our object is to destroy or arrest the activity of a specific organism which is at work within—a very different end to keep in view; and I fail to see any practical or logical *à priori* argument against the conclusion, that it may be possible to impose conditions on an organism which is

spreading through the pulmonary tissues which shall prove inimical to its growth and reproduction, and that is what is meant by the antiseptic treatment of phthisis.

But a complete antiseptic treatment, though it may be possible, no doubt requires minute care in carrying it out in detail.

It is not a little instructive in connection with the history of this subject to find Dr Copland, many years ago, recording the fact that a young man who had repeatedly come under his observation in an advanced stage of phthisis, completely recovered his health after he had been for a considerable period employed in the manufacture of creasote; and at the end of his 'Historical Sketch of the Treatment of Pulmonary Consumption' he observes:

"The inhalation of the fumes of tar or of creasote, or of the terebinthines, very weakly diffused in the atmosphere breathed by the patient, is in some cases beneficial in impeding the advance of tubercles or the formation of cavities, and in healing the surfaces of cavities which have been formed."

Valuable testimony has been given by Dr Lemaire and Dr Sansom as to the efficiency of the inhalation of "carbolic air" in phthisis.

Dr Lemaire gave carbolic acid also internally in aqueous solution. He found very remarkable effects follow its use. There was diminution of cough after twenty-four hours, and in some cases almost a complete disappearance after a few days. The expectoration was diminished or almost suppressed, and if the sputa were offensive, their fœtor disappeared. In many, the physical condition of the respiratory organs was ameliorated. Some were cured, in others there was a subsidence or disappearance of *râles*, and parts became pervious to air which had previously been impervious. In other cases he had noticed increase of strength, return of appetite and sleep, increased freedom of breathing, and general exhilaration.

Dr. Jaccoud, the eminent Professor of Medicine in the Faculty of Paris, in a treatise which he published last year on the 'Curability and Treatment of Pulmonary Phthisis,' thus testifies to the good effect of creasote given internally. The "pure creasote of the beech-tree" is the preparation used by preference in Paris. "This remedy," he says, "more rapidly and more surely than any other diminishes the expectoration and limits the extent of the catarrhal lesions, and thus reduces considerably the area

of the pulmonary changes. But that is not all ; and I am induced to believe that creasote may act on the *fundamental lesions themselves, the tuberculous lesions*, and promote indurative changes, which, as you know, is the method of cure." He mentions the case of a young girl, twenty-two years of age, who was in the hospital three months with infiltration and softening at the left apex ; and, after the creasote treatment, she became greatly benefited, and was discharged fifteen pounds heavier. The signs of "peritubercular catarrh" had disappeared, the dulness had greatly diminished, and breath-sounds had to some extent reappeared. She remained in good health for two years, when she was readmitted with an attack of bronchopneumonia from exposure to severe cold. She was very ill, but recovered to some extent ; and, when convalescent, she was obliged to leave the hospital, and was lost sight of.

In another case quoted by Jaccoud, of a young Russian thirty years of age, he observed the area of infiltration and softening at the apex of one lung diminish one half under the creasote treatment. "This amelioration has lasted two years, and is still maintained ; and the state of the patient's general health is par-

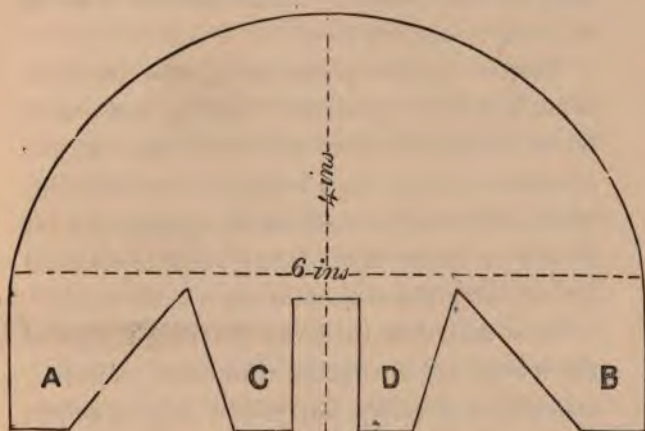
ticularly good." He considers creasote a "precious medicine," and it now forms a "fundamental part" of his treatment. His method of giving it is to begin with a very small dose, to increase it very slowly, and to maintain its administration for a very long period. He never gives at the commencement more than three minims in the day, often less, increasing by one minim every ten days, rarely exceeding five minims, and never exceeding six. He wisely objects to its being taken pure in capsules, on account of its irritating effect, in this concentrated form, on the gastric mucous membrane. He prefers that it should be added to the cod-liver oil, if the patient take this; if not, that it should be given in glycerine. He has found that the addition of creasote to cod-liver oil has often had the effect of enabling patients to take the latter, who were unable to do so previously, adding to the dose one drop of essence of peppermint. His formula for creasote in glycerine is as follows:—Glycerine, 10 drachms; brandy or rum, 2 drachms; creasote 3 to 6 minims; a third of this to be taken three times in the day.

Besides the internal use of creasote Dr Jaccoud is in the habit of recommending the

inhalation of a spray of carbolic acid in cases where the disease has advanced to the formation of vomicae, chiefly with the object of preventing the absorption of putrid secretions and *débris*. But it seems practicable to obtain the good effects of antiseptic agents without the necessity of using a spray, which entails a certain amount of trouble, and can only be applied occasionally ; whereas, with the plan I am going to advocate, you have the decided gain of being able to apply the antiseptic inhalation almost continuously, and of almost any degree of strength. Several instruments have been devised for the purpose of diffusing an antiseptic vapour through the atmosphere the patient breathes. I have found none answer better than the simple contrivance I am now going to describe to you. It has the great advantage that it practically costs nothing. A dozen such inhalation-respirators as those you see on the table before you cost less than a shilling ; and, with a little instruction, a nurse can make one in a few minutes. My patients in this hospital have long used them.

You take a piece of paper about six inches long and four wide ; you fold it along the middle, and cut it with a pair of scissors into

this form. This is your pattern. You place



this, as I now do, on a piece of perforated zinc which costs about sixpence a square foot, and then, with a pair of stout scissors, you cut out a piece of zinc of the same size and form as the paper. You see I have cut out a piece of perforated zinc of the size and shape of the piece of paper I showed you. Now you see by a little manipulation, for this zinc is very pliable, I can bring the two outer ends (A and B) together, so as to slightly overlap; and then, fixing them together with a twist of fine wire passed through the holes of the zinc, I get a suitable mouth-piece, or rather nose and mouth-

piece, for it is important, I consider, to cover both nose and mouth. This can be bent to fit comfortably any face.

The two middle pieces (c, d,) now stick out behind, and, by gradually bending first one of these down, and then the other over it, you construct a little cage behind the mouth-piece which will hold a small bit of sponge, or a bit of tow or cotton wool, or any suitable material for retaining the antiseptic vaporisable fluid.

It is desirable to cover the rough edge of the mouth and nose-piece with some projecting material, it matters not what; I have, as you see, used tinfoil; a loop of elastic on each side serves to attach it behind the ears. It can be covered with black silk or any other material, according to taste, but no covering is really necessary. You see nothing can be easier than the construction of an inhalation-respirator of this kind; and it costs so little that it can be given, without hesitation, to hospital and dispensary patients. It is light and comfortable to wear, much more so than some other more expensive contrivances, and patients find no difficulty in sleeping with it on.

Now, there are many antiseptic substances the vapour of which may thus be continuously,

or almost continuously, diffused into the air that is breathed. Your choice may depend somewhat on the taste of the patient, or you may change the applications, from time to time, until you find out, in each case, which is most useful, and best supported by the patient.

Some simply keep the sponge (or tow) moistened with carbolic acid; others prefer creasote, and others use spirits of turpentine. I have used all these alone, as well as in combination. I have also used eucalyptol, thymol, terebene, camphor, fir-wool oil (*oleum pini sylvestris*), solution of tar in rectified spirit, tincture of benzoin, tincture of iodine, &c. Specimens of these substances are on the table before you, and I hand round to you inhalers charged with several of them. Of all these, I prefer creasote; but I also frequently use carbolic acid and eucalyptol, with which I sometimes mix a little camphor. Turpentine is a useful addition as an astringent where there is profuse secretion or a tendency to hæmorrhage. Camphor has been said to be a very powerful antiseptic, but it has the objection of diffusing itself very rapidly, and is unpleasantly pungent and penetrating. I have also found it a very convenient

plan to mix these substances, such as creasote, carbolic acid, eucalyptol, or turpentine, with equal parts of spirits of chloroform. It helps to diffuse and vaporise these substances, and it is itself somewhat of an antiseptic; and it has also a soothing effect on the often irritable bronchial mucous membrane. I have often seen a patient tormented with cough at night, so much so as to be unable to get any sound sleep, obtain perfect relief from this distressing symptom by using at bedtime one of these inhalations in an instrument of this kind. The quantity required for this purpose is often quite inconsiderable; it is rarely necessary to use more than twenty minims of a mixture of equal parts of creasote and spirits of chloroform dropped on the sponge at a time, and renewed occasionally as it becomes exhausted; and it is often desirable to begin with very small quantities, until the patient gets used to the vapour. Five drops of the mixture may be dropped on the sponge at a time, and gradually increased to fifteen or twenty. One of the advantages of the little inhaler I have described to you is that, being perforated all over, the access of air is unimpeded, while the vapour diffuses itself freely into the immediately surrounding

atmosphere. With more solid inhalers, patients will often say they feel "stified" and refuse to use them.

The substances I have named are, I believe, the best for continuous, or almost continuous, inhalation; for occasional inhalation, you will find a weak iodised vapour often very useful; and even a very dilute chlorine vapour is well borne by some patients. But in these matters, as I have already said, you must consult in some measure the tastes of your patients.

Iodine vapour may be diffused through a room or small chamber by throwing fragments of iodine on a heated plate, as I now do; or it may be inhaled from the surface of hot water, by pouring a few drops of tincture of iodine on the top of hot water contained in a suitable vessel, and holding the mouth and nose over the vapour, with some light covering over the mouth and nose and vessel. The vapour of tar may be inhaled in the same manner. A sleeping apartment may be impregnated with tar vapour by putting some tar on a heated metal plate, or stirring a vessel containing tar with a piece of heated metal of any kind. Other antiseptic substances which are not volatile or are vaporised with difficulty may be

inhaled in solution in the form of spray. A Siegel's spray-producer is the instrument usually employed for this purpose.

A substance which has been given in Germany, and recommended as an antiseptic in cases of tuberculosis by Dr Max Schüller of Griefswald and Dr Rokitansky of Innsbruck, is the benzoate of soda. This they give in the form of spray, *i.e.* the two to five per cent. solution in distilled water. But the great objection to this mode of treatment was the amount of fluid it was necessary to inhale (twenty ounces of a five per cent. solution daily) in order to take in the minimum dose. The patient would have, as indeed Dr Max Schüller says, to devote his life to his cure; for you cannot inhale a spray and do anything else at the same time, whereas the inhalation of an antiseptic vapour by the method I adopt can be continued at the same time with almost any other occupation.

I have adopted this plan of treatment in a number of cases, and in nearly all of them it has been attended with conspicuous benefit. Even in somewhat advanced cases, it allays the cough, lessens the amount of expectoration, and diminishes the fever.

There is a young girl, twelve years of age, in the hospital now, an orphan with no obtainable family history, who was admitted three months ago in a wretched general condition, and apparently sinking from rapid phthisis. There was dulness all over the left side, with co-extensive moist crepitant and coarse râles; there was diminished resonance over the upper half on the right side, with diffused bronchial râles. The temperature was high and fluctuating, constant cough, much dyspnoea, loss of appetite, and great emaciation. She has been kept inhaling a mixture of equal parts of eucalyptol and spirits of chloroform; and, considering the miserable state in which she was on her admission, she has mended wonderfully. She coughs now very little; her appetite is good; she has gained flesh, and become quite cheerful. The moist sounds have completely disappeared from the right side, where the resonance is now good; and on the left side the catarrhal sounds have, to a great extent, disappeared, and the dulness is now limited to the upper lobe. She continues, however, to manifest a subfebrile fluctuating temperature.

I could enumerate a great many cases which have come under my care during the past five

or six years in which remarkable results have followed this method of treatment when it has been honestly and faithfully carried out ; but I must not weary you with these details. I cannot, however, forbear to call your attention to the particulars of a case I have quite recently had under my care, and in which, I must say, I have never seen better immediate results from this or from any other kind of treatment. I first saw the case on the 6th of May. The patient was a married lady, twenty-eight years of age, living in a low damp locality, who had lost two brothers from consumption, one at nineteen the other at twenty-three years of age. She had had a cough for two years, and had been losing flesh. She was confined last Christmas, since which time she had been worse. Night sweats were constant ; the cough was troublesome, and expectoration abundant. Her voice began to be hoarse a fortnight ago, and was now nearly lost. Her appetite was bad. Pulse 112 ; respirations 20 ; temperature 101° Fahr. She was considerably emaciated. There was some dulness over the left apex in front and behind, with moist clicks at the end of inspiration, and some diffused largish crepitations on coughing. On the right side, sub-

crepitant râles were heard over a spot just below the angle of the scapula, where there was also a patch of dulness. She was ordered to wear as constantly as possible one of my inhalation respirators, charged with from five to twenty drops at a time of a mixture of equal parts of creasote and spirits of chloroform, so as to breathe an atmosphere only as strongly impregnated with the antiseptic as was quite comfortable to her. She was also to rub into the chest a mixture of turpentine and iodine liniment, and to take three times a day a mixture, each dose of which contained three grains of hypophosphate of lime, two grains of quinine, twenty drops of the syrup of phosphate of iron, and half a drachm of glycerine, and to continue the cod-liver oil she had been taking. She was also ordered to leave the place in which she was living, and go to some dry, bracing locality. It was agreed that she should go to an isolated farm-house built on a hill three hundred feet above the sea, between thirty and forty miles from London, on the borders of Hampshire and Surrey, where there were pine woods and open heather country. She came to see me again after about three weeks, and she had improved immensely. The temperature

had become normal ; the night sweats entirely disappeared after a week of the treatment ; her voice had returned after ten days ; the cough and expectoration were greatly lessened. The dulness of the left apex was much less evident, but respiration there was feeble, and there was a distinct pleuritic creak in the left supraspinous fossa, a notable sign of past mischief in that region ; all the moist sounds had disappeared. Her general condition had completely altered.

I have never seen a more striking improvement in so short a time, under any plan of treatment or in any locality. But this patient had been unusually obedient to the instructions that had been given her. She had devoted herself at once and unhesitatingly to all the details of the treatment. She had removed immediately to an aseptic if not an antiseptic atmosphere ; she had passed a great part of her time in a hammock, suspended between fir trees, in the situation I have mentioned, and she had perseveringly worn her inhaler as I had directed.

But there is another antiseptic method of treatment which has come into general reputation within the last ten or twelve years, and of

the advantage of which in certain cases there can be no kind of doubt. I allude to the removal of consumptive patients to the dry, pure, cold air of elevated regions. The low temperature of these regions may have much to do with limiting the vitality and propagation of the tubercle organisms. But I have gone into this question fully elsewhere,* and I need not go over that ground again here. I will, however, refer to a remarkable passage in a letter from a well-known resident in one of the chief of these resorts, Davos Platz, which seems to me to have great significance with regard to the question of the contagiousness of consumption. Speaking of the overcrowding that has taken place in that locality, he says: "The tendency at Davos has been . . . to pack the patients together in as small a place as possible, and to build new inns at the doors of the old ones. All this is done in a climate where winter renders double windows and stove-heated buildings indispensable. All this is done for a society where the dying pass their days and nights in closest contiguity with those who have some chance of living. Within the last few weeks, two cases have come under my

* 'Health Resorts and their Uses,' chap. iii.

notice : one, that of a native of Davos attached to the service of the visitors ; another, that of an English girl, who had both contracted lung disease in the place itself, owing, as I believe, to the conditions of life as they have recently been developed here " (Mr J. A. Symonds, in the ' Pall Mall Gazette ').

Now, if the infective character of tuberculosis were generally recognised, and the tuberculous nature of pulmonary consumption generally admitted, mistakes of this kind would hardly be committed. So, again, the antiseptic influence of sea voyages is greatly interfered with by the unavoidable occurrence of bad weather necessitating the confinement of the invalids in close overcrowded cabins, in which the atmosphere they may have to breathe, for days and days together, is anything but antiseptic.

In conclusion, let me again remind you that you will fall into a serious error if you carry away with you the idea that the treatment of phthisis is to be altogether comprehended in the inhalation of an antiseptic vapour. It is a part, and only a part, of the rational treatment of phthisis.

I know of no disease in which so many and various indications for treatment arise during

its progress. But, if pulmonary phthisis be pulmonary tuberculosis, and if tuberculosis depend on the presence of an infective organism in the tissues, a rational treatment of phthisis must include the administration of antiseptic agents, or the surrounding our patients with antiseptic conditions.

NOTE I

ON THE ANTISEPTIC TREATMENT OF PHTHISIS

SINCE the delivery of the preceding Lecture my attention has been directed to some very recent reports, published in Germany, bearing on the antiseptic treatment of phthisis. Dr Fränkel ('Centralblatt,' June 10th) has been making experimental injections of antiseptics into the pulmonary tissues of animal—such as carbolic acid, boracic acid, iodoform, tartrate of alumina, &c.

These injections were not attended with any constitutional disturbance; and the post-mortem examinations showed the existence of extravasations and simple inflammatory changes in the lungs; and, in later stages, the formation of cicatricial tissue. On the strength of these results, he proposes that similar injections should be made into the foci of disease and their neighbourhood, with the view of modifying the morbid process and of limiting its extension by cicatricial barriers.

In a patient with fetid expectoration he administered six injections, each of fifty minims of

a 5 per-cent solution of carbolic acid. It excited no reaction and no cough, but had no effect on the expectoration. I mention these experiments without, for the present, offering any opinion as to their value, merely to show the activity with which this subject is being investigated in Germany.

NOTE II

ON THE INHALATION OF SULPHURETTED HYDROGEN IN TUBERCULOSIS.

EXPERIMENTS on the inhalation of sulphuretted hydrogen in tuberculosis have been made by Professor Amaldo Cantani, of Naples; he has observed, in conjunction with two of his colleagues, the good effects resulting from the employment of the waters of the solfatara of Pozznoli. These contain sulphuretted hydrogen, as well as some sulphuric acid. They administered the concentrated waters internally and also submitted the patients to the action of the vapour in specially constructed chambers. They report the following results:

1. Although the patients objected at first; they subsequently became quite tolerant of the sulphuretted hydrogen vapour, and no bad effects followed.

2. The patients so treated became quite free from fever in a few days.

3. The progress of the local disease was arrested during the treatment and the expectoration was diminished.

Professor Cantani is continuing his observations.

NOTE III

ON BENZOATE OF SODA IN PHTHISIS

THE history of the attempt to treat phthisis antiseptically by the inhalation, in spray, of solution of benzoate of soda is related in the following extracts. In the 'Brit. Med. Journ.' of December 20th, 1879, I made this communication:

"I have now before me a private letter from Dr Max Schüller, of Griefswald, and a copy of a short article by him, on the "Treatment of Tuberculosis," extracted from the 'Berliner Klinische Wochenschrift.' They both refer to a question of so much interest and importance that they merit something more than a passing notice.

"The substance of Dr Max Schüller's letter is as follows:—Some months ago, he published a paper describing experiments he had made on tuberculous or scrofulous rabbits, in order to study the effects of a treatment based on the theory of the bacteric origin of this disease, or rather of the artificial disease in his animals. These animals were infected by the throat with tuberculous matters, and so made tuberculous. Then he derived from the tubercular matters a small form of round bacterium or coccus by a process of Professor Klebs, of Prague, which he names "*fractionirte Cultus*;" and with these he made the same experiments, and with the same results—viz. tuberculosis of the internal organs and a tuberculous inflammation of an injured knee-joint. He was thus convinced that tuberculosis in his animals was a disease caused by living elements or special organisms (*Monas tuberculös* of Klebs). He then tried certain

drugs which he believed would have an inimical effect on the said organisms, and he found that, of the similarly infected animals, those that were not treated all died in variable times; while those submitted to treatment not only remained alive, but recovered their health and increased in weight. He thought the results of his experiments justified him in appealing to medical practitioners to give a trial to what might prove a causally indicated treatment for a disease hitherto without any remedy. Professor Rokitsky, of Innsbruck, was one of the first to accept this invitation to make observations on man, and he is stated to have obtained good results. Dr. Max Schüller regrets that the newspapers should have published paragraphs with such sensational titles as "No more Tuberculosis:" and he believes that the application of this mode of treatment to human subjects is attended with many more difficulties than in the case of animals, and that it requires to be continued for several months.

"The drug he especially recommends is the benzoate of soda: this is inhaled in solution (2 to 5 per cent.) in distilled water, and by means of a spray-producer. For a man of average weight (sixty kilogrammes), the daily dose is from thirty to sixty grammes. If the stronger inhalation be not well borne, the drug can be given internally for several months, five to ten times a day, in gramme doses, in milk, and then weaker inhalations may be used. He considers it most important that the inhalations should be persisted in as often and as regularly as possible, through weeks and perhaps months; and the patient must '*devote his life to his cure.*'"

"As, in order to give the smaller daily dose,

viz. thirty grammes, it would be necessary for the patient to inhale the spray of twenty ounces of a 5 per cent. solution in the twenty-four hours, an ordinary Siegle's spray-producer would prove quite inadequate, and it would be necessary to employ one of those used for surgical antiseptic dressings.

"In private practice, two to four times a day will be often enough for the inhalations of the spray, and such inhalations should be prolonged for half an hour. The patient should, at first, be recommended to make as little effort as possible in inhaling, and only by degrees should he be allowed to make deeper inhalations. A period of rest should follow each inhalation.

"Benzoate of soda (as obtained from Messrs. Bell and Co., Oxford Street), is a white granular powder, with a faint odour of benzoin, and a sweetish not unpleasant taste. It is freely soluble in water. It is sold at one shilling and sixpence the ounce, and therefore is not very expensive, as has been stated."

The above is a condensed account of Dr Max Schüller's recommendations and directions.

The excellent results at first reported by Professor Rokitansky, of Innsbruck, were soon called in question by several physicians in some of the principal towns in Germany, and their reports were thus summarised in the '*Brit. Med. Journ.*' of January 3rd, 1880 :

"Dr. Guttman, of Berlin, treated over thirty-one phthisical patients, of whom twenty-four were men and seven were women, from seventeen to fifty-six years of age. The phthisis was in the majority of the cases very extensive, often having proceeded to the formation of considerable cavities ; in a smaller number of cases, the

disease was relatively lighter—cases which were at times either altogether free from fever, or which were running their course with only slight fever. Those patients were purposely chosen for this observation whose temperature showed a well-marked hectic type, that is to say, low morning temperatures, high evening temperatures, and moreover who, during the latest part of their stay in the hospital, had shown a certain steadiness in their temperature-curves. Any influence of the treatment by inhalation could, therefore, be very easily observed in the temperature-curves of such patients. The temperature was taken three times a day at the same periods—morning, midday, and evening. The inhalations took place twice daily—morning and evening. The solution of benzoate of soda was a 5 per cent. solution in water. At first, Dr. Guttman prescribed only five grammes of benzoate of soda daily, that is to say, the inhalation of one hundred grammes of solution; later, he rose, in the case of five patients, to ten grammes of the substance, that is to say, two hundred grammes of the inhaled solution a day. When Rokitan-sky's communication appeared, in which he intimated that his patients had daily inhaled the one-thousandth part of their body-weight of benzoate of soda in substance, that is to say, fifty grammes of benzoate of soda in substance per fifty kilogrammes of body-weight, and therefore a thousand grammes of the solution, then Dr. Guttman also raised the prescriptions of the patients to these large quantities. Of the thirty-one patients, fifteen inhaled during three weeks; one for two days (the latter had during this time consumed seven hundred and ten grammes of benzoate of soda in substance); six

patients inhaled during from fourteen to nineteen days. Of these, one took six hundred and fifty grammes of benzoate of soda in substance. The remaining nine patients inhaled during from three to twelve days. In four of these who did not tolerate inhalation, the benzoate of soda was given internally, in the quantity of from twenty grammes of benzoate of soda to two hundred of water (one tablespoonful every two hours). Of these thirty-one patients, nine died—seven men and two women; two were allowed at their own wish to leave the hospital; and the rest were still there. The result obtained was as follows:—In not one case—not even, therefore, in the patients who inhaled daily a thousand grammes of the solution—was the temperature in any observable manner lowered by the benzoate of soda, nor was any influence exercised on the temperature-curves. Dr. Guttman adds that the internal use of the benzoate of soda, during a considerable time in which a daily quantity of about eight grammes in substance was taken, was equally without influence on the febrile temperature. On the second notable factor in the progress of phthisical patients, improvement or falling off in weight, the treatment with benzoate of soda was equally without influence. In most cases the weight of the body fell off progressively, in proportion to the amount of pyrexia and exactly in the same manner as though the patients had not been undergoing treatment during this time. Only in one or two patients, in whom the fever was throughout and from the first slight, did the body-weight remain stationary or slightly increased. Neither did the local symptoms of the phthisis undergo any change during the course of the treatment, in the sense

of improvement. Dr. Guttman observed, indeed, that the catarrh and bleeding diminished shortly after the inhalations; that is to say, that the patients coughed and expectorated less for about an hour after the inhalations were over. This, however, he attributes to the fact that the inhalation, and the continuous deep inspiration required while it was going on, excited during the time a much more considerable amount of coughing by irritation; and thus, during the period of inhalation, a much more considerable amount of expectoration was induced—thus clearing the cavities and tubes, and giving rise to less expectoration for a short time after the inhalations had ceased. There was no permanent improvement either of cough or of expectoration after the inhalations, nor were the nocturnal sweats, when these were present, at all lessened by the benzoate of soda. While in not one case was any symptom of phthisis observed to be improved by inhalation; on the other hand, an occasionally unpleasant incidental action of the benzoate of soda was observed. A good many patients complained of nausea and some of vomiting, symptoms which, partly at least, were excited by the continuous stretching forward of the tongue during inhalation, on which Rokitsky lays considerable stress, in order that the inhaled substance might reach the air-passages. It appeared to be partly due to the fact that the benzoate of soda acts as an excitant on the mucous membrane of the stomach, in so far as it reaches it by the inhalations through the œsophagus, and so onwards. Guttman has observed in one case, on post-mortem examination of a phthisical patient who had inhaled benzoate of soda quite up to the end of his life, a recent and

general capillary congestion of the mucous membrane of the stomach. In the post-mortem examination of nine phthisical patients, who had inhaled benzoate of soda, nothing was found in the pathological condition of the lungs which in any way indicated the commencement of a healing process. There was generally an extensive phthisical change, with cavities filled with fluid pus. In one case of left-sided pneumothorax there was a perforated cavern. Two phthisical patients, who had for several years shown no symptoms of hæmoptysis, were attacked freely with hæmoptysis after inhalations. These researches, therefore, carried on during the same period, in the same manner as those which were published from Rokitansky's clinique, are in absolute and complete opposition to them."

Similar results to those of Dr. Guttman, of Berlin, were obtained by Dr. Wenzel, as well by Professor Drasche, of Vienna. As I have remarked in the text, it was simply waste of time to attempt to test any method of treatment by applying it to cases so advanced and hopeless as were these which are here mentioned. Moreover, Professor Oertel, of Munich, in a volume he has just published on the 'Therapeutics of the Organs of Respiration,' in which he devotes about 350 pages to the subject of "Inhalations," speaks highly of the use of a 5 per cent. solution of benzoate of soda, atomised—*i.e.* inhaled in the form of fine spray. He has observed a very cleansing effect to follow its use in the ulcerative lesions of laryngeal phthisis; and he infers from this that a similar favorable action may be exercised on the lesions of more deeply seated parts, on the bronchial ulcerations and softening, and on the walls of cavities. The expecto-

ration is facilitated—increased at first, and subsequently diminished. Mycotic processes and decomposition of the secretions are arrested; and the absorption of secretions is thus favorably modified, and is less likely to be pyrogenic or specifically infective. He also points to the importance of thorough cleansing of the mouth and fauces; the appetite is thereby improved, and the stomach is spared the infliction of decomposing oral secretions. The swallowing of a certain amount of the solution he considers of great value, as he believes it operates in diminishing the fever. He duly discredits the marvellous results claimed for this plan of treatment by Rokitsky, but sees no reason to deny the correctness of Schüller's impressions, as to the results of his experiments on animals, performed under conditions very different from those obtaining in the subjects of advanced phthisis. He, moreover, expresses a confident belief that, by this and other antiseptic modes of inhalation, very good effects will be attainable.

APPENDIX

OPINIONS AND EXPERIENCE OF THE ANTISEPTIC TREATMENT OF PHTHISIS

IN the present state of the discussion of the subject with which the foregoing lecture deals the testimony of independent observers is of great value. I have therefore collected in this appendix extracts from the published opinions of several practitioners of experience and repute bearing on the antiseptic treatment of phthisis.

The following remarks on "Pulmonary Phthisis treated Antiseptically," are from a paper by Dr W. Williams, Physician to the Royal Southern Hospital, Liverpool, published in the 'British Medical Journal,' July 23rd, 1881.

"The use of inhalations, and even of antiseptic inhalations, in the treatment of lung-disease, dates from no recent period. My object to-day is to lay before this meeting certain clinical facts which I have gathered while making an endeavour—with what success you will be able to judge—to bring the principles of Professor Lister's antiseptic method to bear upon the treatment of cavity or abscess of the lung. It is not so much, then, to the impregnation of the inspired air with vapour as its purification that I wish to draw attention.

"An abscess once established, systematic infection, with rigors, fevers, sweats, rapid wasting, and, what is of far greater importance, the setting up, by means of emboli disseminated by parts already affected, of foci of similar disease at a distance in the same, or in the opposite lung, are liable to take place. This is a mode of ingravescence which undoubtedly prevails, and, indeed, forms the principal features of most, if not all, cases of advanced phthisis; and that the study of it forms the surest guide to successful treatment is, I think, no isolated opinion. The patient, although he may have every possible attention, cannot possibly derive the benefit which would, under more favorable circumstances, be secured him so long as suppurating cavities containing septic pus are allowed to exist in the lungs, constantly exercising their pernicious influence on the blood.

"The surgeon, with the resources at present

under his command, has no difficulty in obviating the occurrence of the above untoward contingencies; and it will be my endeavour to show with what success I have been able to employ in the treatment of cavities in the lungs the means all but infallible in their application to external wounds.

"It is a principle of treatment now universally recognised, that an abscess must be freed of its contents, kept empty by free drainage, and insulated or protected by antiseptic media from the septic influence of the surrounding atmosphere. These conditions being duly fulfilled, experience amply proves that any constitutional disturbance which has already appeared may very well be allowed to take care of itself, as under these circumstances the local lesion will quickly cease to be anything more than a local lesion.

"Free drainages from abscesses or cavities in the lungs is undoubtedly in by far the majority of instances not to be secured; we know that they owe their most characteristic features of being rife sources of systemic infection, or septicæmia, to the fact of their contents being retained while exposed to the septic influence of the air breathed; and the partial discharge that does take place is but periodically produced by the compression which the lung experiences during coughing—a method of evacuation that suggests to one's mind an attempt being made to cure the abscess by squeezing out the contents instead of providing, in addition to antiseptic protection, an efficient opening for a spontaneous and thorough drainage. For this reason, it will appear that all the conditions favorable to the complete carrying out of the Listerian method do not ordinarily exist here. One essential to the system—free drainage—we have seen to be

frequently absent ; but while admitting the full significance of this fact we are, I think, bound to confess that the condition which is applicable is scarcely the least important of the two. No one, for instance, would deny antiseptic protection to a suppurating cavity because he was unable to empty it ; and simply for that reason would not a suppuration cavity in such a state, and with the risk of septicæmia which especially attaches to such a state, rather call for this guard against by far the worst accident that can arise ?

“From the time when, more than two years ago, I first attempted to bring the antiseptic system to bear upon chronic phthisis, I have become more and more convinced that it is the only treatment which promises to fulfil all the requirements of these cases.

“In the ordinary application of Professor Lister’s system the fact is recognised that carbolic acid, except to rid the wound in the first instance of septic germs, is not a good application. So far as the raw surface is concerned, it is irritating ; and to counteract this drawback a piece of prepared oiled silk as a protective is invariably placed underneath the carbolised pad. To a certain extent, air circulates through the covering of gauze ; and air purified by the filtration which necessarily takes place is, therefore, in constant contact with the surface of the wound, and with the discharge which lubricates that surface. Have we not, I will ask, an exact parallel to this in the application of the same principle to the lungs ? I believe we have, even to the preliminary cleansing of the foul surface alluded to.

Respiration ensures the circulation of air to perfection ; while, as it passes through the re-

spirator, it is not only purified, but it also becomes impregnated with a certain amount of the carbolic vapour given off by the gauze. The quantity inhaled of this vapour may, for any single inspiration, be quite insignificant; but when multiplied by the number of inspirations made in only a few hours, it does not seem difficult to believe that the amount would soon be sufficient to accomplish the disinfection of all the purulent cavities already in communication with bronchial tubes. That this end is actually gained, and even rapidly gained, my experience certainly tends to prove; and I find moreover that, on the disappearance of odour, it requires subsequently the presence of very little carbolic acid on the gauze to keep the expectoration permanently free from fœtor, as though the ulcerated surfaces having been rendered aseptic, all that remained to be done was to ensure against their reinfection by the inspiration of only pure air, and also to obviate the risk of creating irritation by breathing that which contains but a minimum quantity of suspended carbolic vapour.

“So far as my observations go, they also tend to show that fetid pus from the lungs is not so rich in bacteria as putrid matter from some other regions; and this may be the explanation of the facility with which odour disappears under this mode of treatment: there being but few organisms to kill, the work is soon completed.

“Three of the six slides which I show to-day have been prepared from patients before, and the remainder after, treatment. *You will observe that while they all contain micrococci, only the former show rod-bacteria.* I have only been able to get these few specimens ready in time: that they must not be allowed to lend any support to

the clinical facts must be evident. The matter in each case was taken from recent expectoration, which was immediately dried, stained with methyl-aniline violet, and mounted in Canada balsam. Although the power employed—an eighth objective—is a comparatively low one for the purpose, yet with the aid of Abbé's condenser the micro-organisms are very fairly shown.

“ With regard to the mechanism adopted, the following is a description of the kind of respirator I find to answer best. Over a wire framework, shaped like a respirator, made to cover both the mouth and nose, two or more layers of ordinary antiseptic gauze are stretched; along the concavity inside a narrow strip of sponge is placed, and, finally, the whole is fitted accurately to the face by a circumferential pad made of gutta-percha tissue, stuffed with cotton wool, or folded lint, which is more manageable. Antiseptic gauze in the dry state gives off a vapour of carbolic acid. Bearing in mind, however, the large amount of air that would in ordinary breathing pass to and fro, it will be very evident that this comparatively small piece of gauze must soon become exhausted, and require recharging; this is secured by the whole being dipped every half hour or so at first, afterwards less frequently, into a watery solution of carbolic acid of the strength of 1 in 40; the gauze is, besides, renewed every two or three days. These respirators or dressings are worn as constantly as possible; in fact, the only occasions on which their temporary removal is permitted are during a meal, for the purpose of expectorating, and for that of dipping. Taking into account the apparent inconvenience, it is a little surprising

with what readiness even hospital patients fall into the way of wearing these appliances with the greatest constancy both day and night. It is quite the exception to hear complaints of any kind.

"The following cases present a fair example of the results I have met with :

"CASE 1.—April 3rd, 1879. J. O—, sailor, æt. 19, had three months' illness, originating in exposure. There was consolidation and a cavity affecting the left apex. He had purulent bronchitis throughout both lungs, very great emaciation, rigors, sweating, and diarrhœa. The temperature was 104° at night, and 99° in the morning. Expectoration amounted to thirty ounces in the twenty-four hours—purulent, and very offensive. On the seventh day from the commencement of the treatment, the cough and symptoms were generally much improved; expectoration ten ounces, and free from smell. At the end of four months he left the hospital for his native country (Norway) in much improved health; expectoration two to three ounces, mucoid.

"CASE 9.—December 8th, 1879. J. P—, joiner, æt. 43, had had four months' illness, commencing with cough and repeated attacks of hæmoptysis; emaciation followed, with rigors and night sweats. Percussion over the right apex showed dulness to exist as far down as the fourth rib; a large cavity was also present here; coarse crepitation, with increased vocal resonance at the right base. The left lung was fairly healthy. The expectoration was five ounces in the twenty-four hours, nummular. The bowels were mostly loose; temperature 100° . He had frequent attacks of pain in the right chest.

"December 18th.—Weight 9 st. 11½ lb. He had slight hæmoptysis during the night.

"January 8th.—Weight, 10 st. 6 lb.

"16th.—10 st. 7 lb.

"33rd.—10 st. 9lb.

"March 5th.—Weight, 11 st. 6 lb.; so far as I could gather, his normal weight.

"This patient was discharged cured on March 8th, 1880. I have seen him up to the last three weeks; he continues free from relapse, though the cavity still exists, and he follows his employment.

"CASE 3.—November 7th, 1880. W. C—, a labourer, æt. 19; height 6 ft. 2 in., weight 8 st. 11 lb., slight build; five months' illness. He first had a cough and pain in the chest; afterwards thick expectoration, occasional attacks of hæmoptysis, great wasting, sweating, &c. The thorax was flattened on the left side above; respiration here was cavernous, and accompanied by gurgling; pectoriloquy and cracked-pot percussion note were marked; dulness extended all over the left front and upper third behind. The left lung contained several cavities. The heart was displaced upwards and to the left. There was puerile breathing on the right side. Expectoration amounted to about six ounces, nummular, and occasionally very offensive. Temperature 104° at night, and sometimes a little higher. He was ordered a carbolised respirator.

"He left the hospital, after four months' treatment, for the Convalescent Institution at Woolton. Expectoration was mucoid, a few drachms only; cavities dry. He had not had hæmoptysis for a month, and then only a slight tinge; weight 2 st. 6 lb. He was able to go about as usual. One day, a month ago, this patient called upon

me, when I learnt that he had remained pretty free from cough, and was still improving. The condition of his chest seemed to be precisely what it was on his first leaving us."

Mr Robert Hamilton, Senior Surgeon to the Royal Southern Hospital, Liverpool, referring to Dr W. Williams's communication, observes :—"The inhalation of carbolic acid vapour, in the continuous mode suggested by my colleague, meets a difficulty which I have always felt has stood in the way of all previous methods of conveying drugs to the lungs. He utilises the carbolic gauze of Lister, and merely saturates it occasionally with an aqueous solution of the acid.

"The old forms of inhalers, as well as the modern spray producers, necessitate a quantity of aqueous vapour being introduced into the bronchial tubes and into the air cells, much in excess of what is ever naturally taken in. There is a positive evil in this, such vapour condensing, and being then deposited on the delicate epithelial lining of air tubes and cells, interferes with the osmic movements which respiration induces. That respiration is practically impeded is shown by the coughing and the suffocating sensation produced, so that a very few minutes' use, at one time, of inhalers and vaporisers is all that is possible. The suspension put to natural processes is apt to be overlooked in our eagerness to get the drug brought into actual contact with diseased lung tissue ; and the evil produced by the water is far more than commensurate with the good that the drug can do.

"The mode of conveyance of the minute particles of carbolic acid by Dr Williams's respirator is not open to the above objection ; and as the

drug itself has been tested in surgical practice, and found to be of invaluable service in the treatment of all suppurating surfaces which are accessible, it is fair to infer that, if it can be applied *per se* to the lungs, it may be equally efficacious in checking the growth and development of morbid germs in them, and thus allow tissue to be reconstructed.

"I have treated several cases of phthisis in the way suggested by Dr Williams with good results. The almost constant wearing of the respirator whilst under treatment may be an obstacle to the rapid adoption of the method; but it is, as he says, astonishing how soon the patients become accustomed to the wearing of them. They are only one degree more unsightly than the respirators which many people wear out of doors without hesitation. Further improvement in their shape and appearance is sure to follow if their value be established."

And in a further communication which appeared in the same number of the 'Brit. Med. Journ.' as my lecture, Mr Hamilton makes the following interesting remarks:—"In consumption we have a predisposing condition of the lungs, which may be more precisely described as a state of lung development, that is, of cell-growth, defective in one or more points, either inherited or the result of insufficient surrounding sanitary conditions, and thus not fully commensurate for the work they are called to maintain, or to contend against the malign influences which at times are brought to bear upon them. Now what are these malign influences? They come to the lungs directly through the medium of the atmosphere.

"Giving these malign influences another name

and calling them germs, and surely we may do so with the knowledge we have acquired on the subject, we are brought at once to reason on their *modus operandi*, when they impinge upon a soil prepared for them, in other words in a receptive condition, whether in the lungs or elsewhere, and our reason is founded on analogy. How do another set of germs act when they alight upon a surface freely exposed to them, where formative material on a large scale is being elaborated, as on the stump of a recently amputated limb, or the raw surface of a burn. The action of these germs is to arrest the vital processes of repair, not in its earliest stage, but somewhere along the line just where cell-growth is passing from the general to the particular to become a special form of tissue, and the blood-corpuscle, which was about to be—or had recently been—laid down as an atom in the building up of cellular tissue or connective tissue, is turned aside into the pus-corpuscle, which is, in other words, but a blood-corpuscle deprived of its own vitality and breaking up after it had undergone certain transformations through the action of the sporule of a fungus upon it.

“Before applying this reasoning to what takes place in the lungs in phthisis, we must allow the truth of another of the theories which is now pretty well established as a fact with regard to germs, that is, the specific qualities which so many of them possess. It would take up too much space to give all the reasons in favour of this view, but if it is granted, and how we can account for diphtheria, typhoid, or cholera, on any other supposition it is difficult to see, then the resemblance of the action of germs in the lungs to the action of germs on the fauces, in

diphtheria, for instance, may be thus traced. The air cells of the lungs and the finer twigs of the bronchial tubes weakened by long exposure to a vitiated atmosphere, or not originally in all parts well developed from hereditary causes, receive at some time an air charged with specific germs, and these latter alight on the cell-walls, and put a stop to the progressive changes taking place in those blood-corpuscles with which they there come in contact, and thus arrest to a large extent is put to the perfecting of new material, whilst yet the old and effete continue to disintegrate and pass away. Healthy formative material becomes for a time the nidus out of which the sporules of a vegetable organism multiply.

“(The terms “blood-corpuscles” and “formative material” are here used indifferently, for it is impossible to define at what stage, from the moment of the blood-corpuscles escaping the vessels to their changed condition as germinal matter, the micrococci of a fungus act upon them.)

“But it is not the ordinary non-specific germ such as we meet with in every suppurating surface, but the particular one which has characteristic properties of its own which is the producer of phthisis. When it finds an entrance and a feeding ground prepared for it, and above all certain atmospheric conditions of temperature and moisture, it rapidly converts to its own growth and material development the formative material which the blood has brought to the walls of the air cells. The development of the tubercular germ proceeds in this way to the stage of reproduction and there stops. The parent germ then loses its vitality and disintegrates, and it is this disintegrated germinal

matter that constitutes the purulent expectoration of phthisical patients. It has, however, left its seed behind it, to go through the like stages at the expense of normal tissue.

"(That certain conditions of temperature and moisture are necessary for the development of germ-life has been long known; but it is only lately that we have arrived at the conclusion that each of the specific germs has a temperature and moisture of its own, without which it cannot burst into active life. This holds true of the phthisis germ, as well as of the diphtheria and cholera germ.)

"Looking at the origin and course of phthisis from the above point of view, how should we plan our treatment? Firstly, we want a weapon which shall be quickly fatal to our enemy; and, secondly, we must bring it into direct contact with the foe. These are the two problems we have to solve, and they are surrounded with great difficulties. May we say at least that we are in the right track at last? We are experimenting on the best method of reaching the lungs directly through the trachea, and we are casting about to find the best germicides. These are the specific weapons of our warfare.

"Most medicines can be triturated or in some way reduced into particles lighter than air, and thus become capable of inhalation if brought into close proximity with the entrances to the air passages. I firmly believe that the continuous inhalation of an air moderately impregnated with some, perhaps yet unknown, vegetable or mineral product will ultimately prove the cure for phthisis."

Dr J. G. Sinclair Coghill, Physician to the Royal National Hospital for Consumption, Vent-

nor, writes thus ('Brit. Med. Journ.') on "Antiseptic Inhalation in Pulmonary Affections."

"Antiseptic inhalation is evidently and deservedly coming into notice as a valuable aid in the treatment of a large and important class of diseases; and I believe that it is capable of much greater development and extension, and that it will ultimately play a distinguished rôle in the pulmonary therapeutics of the future. It must, however, be admitted that it has not been adopted as rapidly or as generally as the undoubted indications for its employment would seem to justify. It is somewhat difficult to account for this tardy recognition of means that have been found so valuable in the hands of those physicians who have put it to the test of long and extensive trial.

"The propriety of attacking disease in the local seats of its activity, in addition to treating the constitutional conditions which accompany—not necessarily in the relation of cause and effect—the local lesion, is one which, in the present state of pathological knowledge, hardly admits of question. If this be accepted as a leading principle in the therapeutics of disease in general, how much more readily should its application be recognised in the treatment of affections like those included in the common term of phthisis, where the relation of the tissue-lesion to the constitutional morbid state is not accidental or variable, as it is in many other maladies, but essential and continuous; and where, consequently, their reactions on each other are of primary importance. In the advanced progressive forms of tubercular phthisis, the fever which accompanies the breaking down of the infiltrated and disintegrated pulmonary tissue has long been recognised as an infectious pyrexia, directly

resulting from the absorption of the septic materials from the seat of this retrograde metamorphosis. In pneumonic or secondary phthisis, also, we have a suppurative process set up as a retrograde sequel to the original inflammation of the lung-tissue, ending in an excavation, which is in all essential conditions analogous to a surgical abscess. The natural progress of the two local states—the excavation in the lung and the external abscess, as well as their influence on the general condition—are identical. In both, we have a localised suppurative process, continually invading and breaking down the adjacent sound tissues, exhausting the patient in proportion to the amount of pus thus secreted, forming active centres of disseminating infection, and lowering the powers of the patient by the resulting febrile movement, thus still further diminishing his chances of recovery. But this morbid process is capable of arrest—nay, as the great Laënnec first pointed out, and as all our post-mortem experience amply corroborates—nature herself is equal to the task; but it is none the less the duty of the physician to come to her aid with all the means in his power.

Why, then, should we, as physicians, not recognise that, in all suppurative processes in the lungs, as evidenced by purulent expectoration, we have local conditions presented, calling as loudly for direct antiseptic medication as the wounds, abscesses, and ulcerations which belong to the province of our surgical brethren? But, while the external or surgical employment of antiseptics is an easy and simple process, and its results more immediately apparent, it is very different when we have to introduce our remedies into the interior of the body through an intricate

and jealously guarded portal, as we have in the case of the lungs. That the comparative accessibility, however, of the lungs, through the glottis, should have, even in the earliest times, suggested direct medication, is not surprising; but it is, indeed, strange that inhalation, or taking advantage of the respiratory act for this purpose, which dates from the days of the Father of Medicine himself, should only have received, until comparatively recent times, but occasional and rare employment. That its importance was from time to time recognised there is abundant evidence in the works of the older physicians; and that this importance was even occasionally exaggerated by them is shown by the statement of the celebrated Italian physician, Mascagni, who says: 'If ever a specific should be devised against consumption, it would be such as to be introduced into the organism through the windpipe.' A succession of celebrated names in more modern times, too numerous to mention, is associated with the subject of pulmonary medication by inhaling; and a great variety of apparatus, more or less elaborate, have been introduced from time to time for the purpose. There are, however, great objections, apart from the almost impossibility of their penetrating deeply enough into the tissue of the lungs, to the inhalation of dry powders, however finely divided, on account of their mechanically irritating effect on the often already morbidly sensitive laryngeal and bronchial surfaces. Non-volatile fluids, again, can only be very partial in their distribution; and, if inhaled at high temperature, must further render the upper reaches of the respiratory tract sodden, and increasingly sensitive to changes of temperature. Careful observation of the action and effects of

this steaming process in affections of the lungs has convinced me that it is not only inefficient, but, in every respect, positively injurious. It relaxes the tissues with which the vapour comes into contact; it encourages suppuration where the ulcerative process has begun, and it tends, therefore, to increase expectoration and cough, and consequently the distress and exhaustion of the patient. The inhalation of hot moist vapour, indeed, is so repugnant to the respiratory tract that but a small quantity of the medicated material can penetrate sufficiently into the pulmonary tissue to be of use. The immediately subsequent effects are also not unattended with risk, from the exposure of the air passages to air of a lower temperature after hot inhalation. However beneficial, then, in laryngeal affections (and we are all familiar enough with its value in such) the inhalation of dry powders or of pulverised fluids in the form of spray, either cold or hot, may be, they cannot be regarded seriously in connection with the treatment of suppurative processes within the lung itself.

“It is now more than five years since I became strongly impressed with the important bearings of Lister’s teaching on the local treatment of phthisis; and, in working out the idea of antiseptic inhalation, the considerations above referred to suggested the plan of adopting the principle of the old-fashioned, and now happily almost obsolete, respirator for the purpose—selecting a volatile medium for the antiseptic materials, and employing the breath in the alternate acts of inspiration and expiration as their vehicle. These so-called antiseptic inhalers or respirators were first made to my order by a local tradesman in common tin, of the exact shape and size of the

ordinary metal respirator. These were, however, somewhat primitive in style; and they have since been extensively made by Messrs. Maw and Son in a more elaborate and convenient fashion."

The respirator inhaler Dr. Coghill describes does not cover the nose but only the mouth; this I do not think advisable, as the majority of persons breathe through the nose, and indeed, it is desirable they should do so; and especially, when worn during sleep, it is better that the nose should be covered as well as the mouth. He considers the best times for inhalation an hour or so before going to sleep at night and after the morning expectorations—which leaves the suppurating surface or cavity dry to be acted upon—disinfected, so to speak, by the antiseptic vapour. Many of his patients, however, have worn the respirator almost continuously day and night. He lays great stress on inspiring through the mouth and expiring through the nose in order to secure a complete circulation of the medicated air. But this process would prove very tiring if attempted continuously. Occasionally carried out for a few minutes at a time it is a good plan. He goes on to say:

"After many trials of the now formidable list of antiseptics, I find that carbolic acid, creasote, and iodine, in combination with sulphuric ether and rectified spirits of wine, are the most efficacious and satisfactory. Of the three antiseptic agents I chiefly use I find iodine most useful in the second stage of phthisis, when the expectoration is passing from the glairy into purulent character. I use a tincture, for inhaling purposes, made with sulphuric ether instead of spirits of wine; and this ethereal solution has a singularly soothing effect on the cough and

pulmonary irritation. In combination also with carbolic acid, as carbolised iodine or iodide phenol, it is extremely useful in the purulent expectoration accompanying the resolution of pneumonia, both catarrhal and croupous. In the stage of excavation, whether tubercular or pneumonic, the combination of iodine with carbolic acid and creasote is most potent. The acid seems to have the greater influence in checking the amount and purulent nature of the sputa; while creasote acts more as a sedative in the cough, apparently by reducing the irritability of the pulmonary tissues. The addition, also, of varying proportions of sulphuric ether and chloroform greatly assists in soothing and allaying irritation. These combinations also act frequently like a charm in the profuse expectoration of purulent bronchitis, as also in bronchial asthma. I have also noticed that patients, while using this form of inhalation, frequently experience great relief from the aches and flying muscular pains which often occasion much distress in the advanced stages of phthisis."

The following is a formula which he suggests:—
Tincturæ Iodi Etherealis, Acidi Carbolicī āā ʒij;
Creasoti vel Thymoli ʒj; Spiritus Vini Rect. ad ʒj; to which he adds chloroform or sulphuric ether if the cough or breathing is troublesome.

After quoting several cases in which great improvement followed the use of antiseptic inhalations, he concludes thus:—"These cases have been taken at random, and are by no means those in which we have seen the best results from antiseptic inhalation on the amount of sputa.

"To be able also by this means to dispense, to a great extent, with cough mixtures, *et hoc genus omne*, is in itself no small advantage in the treatment of a class of diseases in which it is so

necessary to preserve, if possible, the appetite, with the digestive and assimilative processes undisturbed and intact. If there be sputa collected in the lungs there must be cough; the *rationale* of treatment then is to prevent, if possible, the material from being secreted which demands cough for its expulsion. To attempt to stifle a cough under such conditions by sedatives is erroneous in theory and most dangerous in practice, apart from the other mischievous effects of preparations to which I have already referred.

"I may say here, that my later and wider experience of this form of antiseptic inhalation in phthisis laryngea, if such a disease exists *per se*, of which I have grave doubts, or, as I would prefer putting it, in phthisis complicated with affection of the larynx, has not been so favorable as my earlier cases led me to expect. It seems to have too drying or astringent an effect; and, in all such cases, a warm moist vehicle is preferable for the antiseptic material, if such be indicated.

"I have now, for nearly five years, employed antiseptic inhalation as a regular part of the treatment in all lung affections characterised by purulent expectoration, both in my private practice and in the Royal National Hospital for Consumption. I find that all patients take to it very readily, become very speedily impressed with the amount of relief it affords, and inclined to continue it on their own account, without the encouragement and suggestion which many other details of treatment often require. Any difficulty on the score of odour is easily met in the great variety of antiseptic materials from which to choose. I have received a great many communications from members of the profession, many

of them in large practice among *poitrinaires*, expressing their high opinion of its value. I am sure the results of this auxiliary to general treatment, in appropriate cases, will be found most encouraging."

The following note on the "Antiseptic Treatment of Lung Diseases" is by Dr J. Carrick Murray, Physician to the Northern Counties Hospital for Diseases of the Chest, and appeared in the 'British Medical Journal,' July 23rd, 1881.

"On May 31st, the medical officers of the Northern Counties Hospital for Diseases of the Chest received, per order, a number of Dr Coghill's inhalers, made by Messrs. Maw, Son, and Thompson; also some of the inhaling mixture recommended by Dr Coghill. The inhalers have been in diligent use since, with satisfactory results, the amount of sputa having in each case lessened. Patients who commenced to cough and spit at four o'clock in the morning can already lie until rising time without coughing. Some of them complain that they do not get the phlegm up so easily as before; but I am of opinion that the sufferers continue to cough more from long habit than from real necessity. I find that our inhaling patients observe the strong smell of the antiseptic in their sputa, and that half an hour twice a day appears sufficient to use the inhaler; also that twenty minims dropped on at once are enough for two days' use. More has been found too irritating to the glottis in the cases in which we have used it.

"I prefer surgeon's lint doubled to cotton wool or tow, and had made for me an inhaler more elegant, a little, than Dr Coghill's. It fastens by a broad india-rubber band at the back of the neck; this does not hurt the ears. The outer

perforated plate is hinged, and therefore more easily manipulated. The makers are Messrs. Henry Aitken and Co., Bishophill, York; the price five shillings each.

"My conviction is that medicated inhalation might be used with benefit in more diseases than Dr Coghill enumerates; *e.g.* in hay fever, influenza, incipient phthisis, or where a husband sleeps with a consumptive wife, or *vice versâ*, hæmoptysis between attacks; chronic bronchitis with profuse, inspissated, or difficult expectoration; asthma from loss of lung tissue; so-called laryngeal phthisis; circumscribed gangrene of lung, &c."

Dr Battersbury of Wimborne, Minster, contributes the following testimony ('Brit. Med. Journ.,' October 21nd, 1881) in favour of the "Antiseptic Treatment of Lung Diseases:—"

"I do not know whether it is generally known that the treatment of phthisis and other lung diseases by the inhalation of antiseptic solutions is not confined to England. My attention was first called to this method of treatment last autumn by a patient of mine suffering from phthisis, who had found great relief from the inhalation of a solution of carbolic acid through an inhaler, recommended to him by Dr von Messing, of Meran, in the Southern Tyrol. The inhaler is made of German silver, and is shaped like an ordinary respirator, but has a cavity enclosed between the outer surface and an inner plate; both plates are perforated, and the outer one can be raised at pleasure for the purpose of placing in the cavity cotton wool saturated with the drug required for inhalation. The instrument is called inhalations-respirator, and is made by W. von Pernwerth of Meran; it

appears to resemble almost exactly the respirator recommended by Dr Coghill, and figured in the journal of May 28th. My patient wrote, asking how these inhalers could be obtained, to Dr von Messing, and he very kindly sent me one; and in his letter to me, dated September 6th, 1880, says:—‘I have heard of your desire to try the inhaler I am using for my patients, and I have ordered one to be sent to you. The value is a trifle and I beg you to accept it from me. I have been using it for about five years, and I am perfectly satisfied with the results. I generally use a mixture of twenty parts of carbolic acid to 100 of water, to be well shaken, and twenty to thirty drops poured out on the cotton. I advise my patients to inhale through the apparatus, and exhale through the nose, three to four times a day, for ten minutes at first and then for an hour; in this last case wetting the cotton two or three times. In cases of bronchitis it affords great relief and shortens the process; also in cases of whooping-cough. In consumption it lessens the fever by absorption of the carbolic acid, and facilitates the expectoration. In chronic bronchitis with bronchiectasiæ, it does away with the smell and disinfects the air passages. Violent spasmodic cough, above all at night, is immediately checked by the addition of fifteen to twenty drops of chloroform.’

“Since receiving this letter I have tried the inhaler with very satisfactory results. In my last case, a case of phthisical consolidation involving a considerable portion of the left lung, and attended with a hectic and purulent expectoration, the weight increased in one month from 7 st. 1 lb. to 8 st. 1 lb., during the use of the antiseptic inhalation; the fever entirely disap-

peared, and the cough and expectoration almost entirely. Now, unfortunately, a fresh patch of inflammation has occurred, which has brought back the fever and cough, but the temporary benefit was well worth having.

"In one case I substituted the oil of *Pinus sylvestris* for the carbolic acid with very good result, and should be inclined to try it again in cases of obstinate chronic bronchitis."

Dr McAlldowie contributes a note ('Brit. Med. Journ.,' October 22nd, 1881) on "The Inhalation of Terebene in Phthisis."

"The antiseptic treatment of phthisis has been so prominently brought before the profession of late, and is a subject of so much importance, that no excuse is necessary for the present brief communication.

"For upwards of four years, antiseptic inhalation has been one of the principal remedies employed by me in the treatment of phthisis and certain other lung diseases. The vapours of creasote, carbolic acid, iodine, and other antiseptics, have been used in more than 400 cases, occurring both in hospital and in private practice. During the past two and a half years I have adopted terebene as a remedy in preference to the antiseptics mentioned above. I have used it in upwards of 200 cases of consumption, bronchiectasis, chronic bronchitis, and other pulmonary complaints characterised by profuse purulent expectoration. It is very valuable, and its vapour possesses antiseptic qualities equal to any of the others. It has also a sedative action, allaying the cough and irritation, and is almost invariably preferred by the patients themselves to any of the other antiseptic inhalations, on account of its agreeable and fragrant pine-wood

odour. In cases where the expectoration is copious and fetid it is advisable to administer it internally in addition to the inhalation of its vapour. Given in doses of five minims, either in emulsion or with carbonate of magnesia, it acts as an aromatic expectorant.

"The researches of Cohnheim and others have shown how liable the lymph-follicles of the intestine are to tubercular infection during the progress of pulmonary consumption, in consequence of the sputa being swallowed by the patient. Administered internally, terebine destroys the virus and lessens the risk of intestinal infection."

Mr Wilson Hope, of Petworth, recommends the following simple method ('Brit. Med. Journ.,' July 16th, 1881) of inhalation in phthisis.

"Cut from an ordinary roll of wadding two pieces large enough to cover the nose and mouth. A diamond-shape answers very well. Now, remove the skin-like substance which coats the pieces; put them together, and fold them in a piece of thin muslin, to the ends of which ribbons may be sewn, and your inhaler is made. I have used it for a couple of years, directing the patient to drop five or ten drops of creasote between the layers of wadding, fold it in the muslin, and to wear it for half an hour two or three times a day, or sometimes through the night. It is well to tell the patient to have two or three of them, as the moisture from the breath spoils the inhaler after a time. There are cases where, merely as a filter, it may be useful; and using it with creasote, I am convinced, is useful in many cases of phthisis, in some cases of chronic bronchitis, and in some cases of diffuse capillary bronchitis in young people."

Dr Robert Saundby, Assistant Physician to

to the General Hospital, Birmingham, writing in the '*Brit. Med. Journ.*' for December 28th, 1881, and giving the preference, as I do, to the naso-oral form of respirator, observes:

"As the use of antiseptic inhalations has proved useful in phthisis in my own practice, and is supported by those who, like my friend, Dr. Sinclair Coghill, have special opportunities of estimating the value of treatment in this malady, I think it is important that we should try to improve the necessary apparatus as far as possible. I have been using for the last year an inhalation-respirator made for me by Mr Best, instrument-maker to the General Hospital, of Sumner Lane, Birmingham. The naso-oral form which I have employed almost exclusively is very well shaped, is light, comfortable, well ventilated, and worn by patients without complaint of inconvenience or fatigue. The antiseptic I have found most suitable is the oil of eucalyptus, in doses of five to ten drops poured on the flax twice daily.

"I do not claim, nor do I think we can rationally expect, to cure any cases by them; but many of my patients have found great relief from their use, mainly in checking purulent secretion and allaying cough."

Mr. Taylor, of Guildford, in the following interesting letter (*Brit. Med. Journ.*, November 5th, 1881) questions the value of the "respirator," but Mr. Taylor's method, while excellent for diffusing an antiseptic vapour through the sick room, is useless and inapplicable in the majority of cases where a respirator can be worn.

"As some of your correspondents are asserting their claims to priority in the treatment of lung disease by antiseptic inhalations, it may not be amiss to recall the fact that this treatment, in

one form or the other, is really ancient. We can see that the germ of the idea was in the mind of medical writers in the sixteenth and seventeenth centuries, when they directed their fumigations with various balsamics, 'which is to be done by throwing the ingredients on red coals, and receiving the fumes through a proper tube directed to the windpipe.' It was further developed fifty years since by Garmul, Scudamore, and Crichton, who severally recommended the inhalation of chlorine, iodine, and tar-vapours; while two of the substances now employed, namely creasote and the terebinthinates, were specially mentioned by Dr. Copland in his 'Medical Dictionary' as valuable remedies in phthisis and chronic bronchitis.

"The only novelty in the modern procedure is the use of a respirator as a medium instead of an inhaler, and I question if it be so great an improvement. My own experience leads me to prefer having the vapour of the drugs in question diffused in the air of the room by means of a bronchitis-kettle, the solution being dropped from time to time on a small piece of sponge placed within the mouth of the steam-pipe. The vapour being thus constantly inhaled, and in a state of greater dilution than when a respirator is used, affords equal benefit, and is more agreeable to the patient. It was precisely this form of inhalation that Dr. Copland recommended in his article on 'Tubercular Consumption,' published more than twenty years ago. But, setting aside the claim of originality, it is only fair to admit that those who have revived the use of antiseptic inhalations deserve great credit for calling attention anew to a remedy of unquestionable value."

Dr Snow, of Bournemouth ('Brit. Med. Journ.' Feb. 18, 1882), testifies to the value of the "Antiseptic Treatment of Lung-Disease."

"For several years I have largely employed dry antiseptic inhalation in phthisis, as an adjunct to general constitutional measures. The treatment I believe to be useful, but every case of improvement must not be attributed to the inhalation. The most suitable cases are those attended with profuse expectoration, especially when softening has commenced or cavities formed.

"The effect is sedative; in a large proportion of cases the expectoration diminishes in quantity and improves in quality, cough becomes less frequent and severe, and sounder sleep is enjoyed, enabling the patient to dispense with objectionable cough medicines. The same effects may be noted when the general progress of the lung-affection is not arrested. I have never seen hæmoptysis produced by its use. As a respirator, I prefer a simple tin-box, perforated and shaped to the mouth, introduced by Dr Roberts, of Manchester. The patient is directed to place a few drops of the carbolic solution on the tow in the box, and to use the respirator for ten minutes after the morning cough, and at intervals during the day. Many habitually use it for hours while reading. If dryness and irritation of the mouth and throat be caused by the carbolic inhalation, other remedies may be substituted—such as terebene and eucalyptus oil.

"To produce an aseptic atmosphere the constant use of the vapour of carbolic acid in the sick room has been recommended; few can be induced to submit to this treatment, which I cannot recommend."

Dr Hunter Mackenzie, Lecturer on Diseases of

the Throat, School of Medicine, Edinburgh, who has devised an excellent naso-oral respirator-inhaler writes as follows ('Brit. Med. Journ,' Jan. 3, 1880), "On the Antiseptic Treatment of Phthisis Pulmonalis.

"Having some months ago found bacteric organisms in the sputum of a phthysical patient, it occurred to me whether their presence might be associated with a process of blood-poisoning from the decomposition and putrefaction of the products of inflammation in the pulmonary bronchi and air-cells. I accordingly experimented with various antiseptic inhalations of different strengths, and latterly have been using pure carbolic acid or creasote. I have had made, by Mr Young of this city, a respirator somewhat resembling that of Dr Roberts of Manchester, but which covers both mouth and nose, and has a double breathing-chamber for containing pieces of sponge saturated with a strong carbolic or creasote solution. The sponge is covered with a light layer of cotton wool, to act as an additional filter and prevent the outward evaporation of the antiseptic. The respirator is worn *as continuously as possible* both by night and day. By this means, not only is the respired air purified, but the volatile antiseptic is drawn in with each inspiration and thoroughly permeates the lungs. A renewed application of the fluid is made night and morning by means of a camel-hair brush. I have had no difficulty in inducing even young children to wear the respirator for lengthened periods, the only drawback having been a tendency to chafing of the skin by the continuous pressure of the borders of the instrument. This, however, has been overcome by having the instrument bordered with soft sponge, which

answers admirably. My experience of this method of treatment has as yet been limited, and confined to cases in their first stage. The results obtained, however, have been so satisfactory as to justify me in discarding the internal administration of the various specifics and continuing the inhalations alone. It is, of course, impossible for me to say that cases of phthisis are absolutely cured by this system of treatment; but the distressing symptoms of phthisis—the night sweats, cough, and impaired appetite—have been so ameliorated as to justify me in publishing this preliminary note, reserving for a future communication further details of the method and notes of the cases tried by it.”

NOTES
ON SOME
VAPORISABLE ANTISEPTIC SUBSTANCES
APPLICABLE TO THE
TREATMENT OF PHTHISIS

SULPHUR AND SULPHUROUS ACID

THE use of sulphur vapour and of a spray of sulphurous acid as an antiseptic in phthisis and certain other diseases, was warmly commended some years ago by Dr Dewar, of Kirkcaldy.

One of his methods was to sprinkle flour of sulphur on a few red cinders on a kitchen shovel, in successive small quantities, until the atmosphere was filled, but not disagreeably, with the fumes. The process could be at once interrupted by putting the shovel under the grate, or modified by opening a window. The operation could be repeated as often as necessary, but he preferred that the sick-room should never be free from a certain amount of the vapour. Dr Dewar devised a spray-producing

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apparatus for applying sulphurous acid, diluted with one or two parts of water, to the air passages; but now a Siegle's steam-spray producer is the most convenient apparatus to use.

Dr Dewar quotes several cases of phthisis in which this "sulphur medication" proved of great value. It has also been stated that those engaged in the manufacture of sulphuric acid are protected against phthisis.

Sulphurous acid has been proved by many observers to possess remarkable disinfecting properties, and it is probably one of the most potent germicides at our disposal. Hoppe-Seyler asserts that 1—2 per cent. of sulphurous acid in the air of a room will destroy all the lower organisms, a condition which will be produced by burning thirty to sixty grains of sulphur for every 100 cubic feet of space.

Sulphurous acid fumes may also be evolved by burning two parts of flowers of sulphur with one part of charcoal.

IODINE

The inhalation of iodine has been found of great value in the treatment of phthisis by

many physicians. A few grains at a time may be vaporised on a hot plate in the sick-room. Or the sponge of an inhalation-respirator may be wetted with a few drops of pure tincture of iodine or of a solution of iodine in ether, or in spirits of chloroform.

Ten grains of iodine dissolved in an ounce of amyl hydride makes a good inhalation (Phillips). Or a spray may be used containing a few drops (10 to 20) of tincture of iodine in an ounce of water.

The "Vapor Iodi" of the pharmacopœia is produced by adding one drachm of tincture of iodine to an ounce of water, supplying heat in a suitable vessel so that the vapour that is driven off may be inhaled.

Some have used with advantage, in the form of spray, a mixture of ten to twenty drops of tincture of iodine and one or two grains of carbolic acid added to an ounce of water. The warmth of the hand suffices to vaporise a mixture of carbolic acid and tincture of iodine. Others have used dry inhalations of a mixture of iodine and camphor.

Sir Charles Scudamore, who had great faith in the value of iodine inhalations in phthisis, believed that the addition of a little tincture of

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conium subdued the irritating qualities of the iodine vapour, when inhaled with the steam of water.

Piorry was a strong advocate of this mode of treatment, and he was so anxious that his patients should breathe the vapour continuously, that he used to have several saucers containing iodine placed about the patient's pillow.

There exists a very strong body of evidence in favour of iodine inhalations in the treatment of phthisis.

iodoform

The inhalation of an ethereal solution of iodoform (1 to 8 or 10) has been used with advantage in phthisis. Its unpleasant odour is an objection to its use. Its insufflation in powder has been found of considerable value in laryngeal phthisis.

Chlorine

The inhalation of diluted dry chlorine vapour as well as the spray of a weak solution of chlorine

and of chlorinated soda, have been reported as of much value in the treatment of phthisis; but the irritating properties of chlorine, except when very dilute, have usually led to the preference of other antiseptic agents. Sir James Simpson thought well of its use and so did Dr Elliotson; but it is probably irrespirable in sufficient quantity to affect disease germs in the living subject.

CARBOLIC ACID

This powerful antiseptic substance has been largely employed in the treatment of phthisis. It has been used in the form of dry inhalation, as a spray diluted with water, internally by the stomach, by hypodermic injections, and by injections through the chest walls into the lung.

The most common and most convenient method of employing it is by dropping a few drops of the pure liquid acid on the sponge of an inhalation-respirator, which should be worn as continuously as possible, and the charge of acid renewed when the odour gets feeble. In this way the air that is breathed is moderately charged with the antiseptic vapour. If the carbolic acid be mixed with an equal part of spirits

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of chloroform the vapour probably comes off more rapidly, and is perhaps more efficacious when the inhalation can only be used occasionally. The spirits of chloroform, moreover, soothes bronchial and laryngeal irritation.

The vapour of carbolic acid can readily and usefully be diffused through the atmosphere of a bed-room or other chamber occupied by the sick person, by making an iron shovel or an old earthenware plate hot over the fire, and pouring the acid upon it. This is an excellent way of diffusing an antiseptic vapour through the atmosphere.

A mixture of camphor and carbolic acid has been used in France as an antiseptic under the name of *Camphor phénique*. It is made by adding powdered camphor to a mixture of crystallised carbolic acid nine parts and alcohol one part. This may be inhaled in the same way as the pure acid. Or a mixture of carbolic acid and iodine may be inhaled as I have already said.

As a spray, a good form is made by adding forty minims of glycerine of carbolic acid and five grains of carbonate of soda to an ounce of warm water, and used in a Siegle's spray-producer.

Carbolic acid has also been given internally, and an excellent vehicle for its administration is a mixture of bismuth, glycerine, and mucilage. A grain or two may be given thus three times a day. Or iodine and carbolic acid may be given together internally. When they are given together "a colourless carbolate is formed when they are dropped into water."

Schnitzler, of Vienna, uses hypodermic injections of carbolic acid, one eighth to one quarter of a grain daily, or twice a day. He finds it reduces fever (a distinct relation exists between antiseptic and antipyretic properties: the power to depress temperature exists in the same ratio as the power to destroy disease ferments, and germs), the pulse becomes slower and stronger, and the night sweats are diminished.

Quite recently Dr Fränkel has been injecting small quantities of a 5 per-cent. solution of carbolic acid into the lung through the chest walls.

CREASOTE

This antiseptic vaporisable substance is obtained from wood tar, the purest being that

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obtained from the wood of the beech tree. There are several varieties, more or less impure, in commerce. Wood says :—"Creasote is at present a rare drug, the material which is usually sold under its name in the drug stores being really a solution of carbolic acid." It differs from carbolic acid in being insoluble in glycerine.

Its vapour is astringent and sedative as well as antiseptic.

It may be inhaled dry in the same way as carbolic acid, either pure or mixed with spirits of chloroform. It may also be inhaled with the steam of hot water.

MM. Bouchard and Gimbert have derived remarkable results from its internal use in phthisis. They give it in the following manner :

Pure creasote of the beech tree	. 27 minims.
Tincture of gentian	. . . 60 „
Alcohol	. . . 1 ounce.
Malaga wine	. . . 4 „

A quarter to half of this is taken daily. Or they give it in combination with cod-liver oil—two parts of creasote to 150 of cod-liver oil. The average daily dose being six to nine grains, but as much as twelve to fourteen grains have

been given. They have found its use followed by diminution of cough, expectoration, and fever, and an increase of appetite, strength, and weight.

TAR

Obtained by destructive distillation of the *Pinus sylvestris* and other pines.

A vast amount of testimony is on record as to the value of the inhalations of tar vapour or of the spray of tar water in the treatment of phthisis.

Tar water (Eau de Goudron) has also been largely used internally in this disease, and is a very popular remedy in France. Tar water is made by stirring a pint of tar with half a gallon of water for fifteen minutes and then decanting. It may be used in a Siegle's spray producer. Siegle considers it an "antiseptic *par excellence*."

The vapour of tar may be readily diffused through the air of a room. Prepared tar, mixed with water till it is soft, may be poured in thin layers on plates, which are kept hot by standing over water which is maintained at a

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high temperature by a spirit lamp. The tar should not be allowed to become dry.

It is soluble in its own bulk of rectified spirit, and the sponge or other absorbent substance (tow, cotton wool) in an inhalation-respirator can be kept saturated with this solution.

The dose of tar water internally is from one to two pints daily.

OLEUM PINI SYLVESTRIS (*Fir Wood Oil*)

This is used by some physicians in preference to oil of turpentine on account of its more agreeable odour. Like it, it is antiseptic and astringent.

It may be used pure or mixed with other antiseptics, and dropped on the sponge of an inhalation respirator, or it may be inhaled with the steam of hot water in a suitable apparatus.

Dr Morell Mackenzie's formula is two drachms of the oil of pine with sixty grains of light carbonate of magnesium in three ounces of water. A teaspoonful of this is thrown upon a pint of water at 150° F. for each inhalation.

OIL OF TURPENTINE

The inhalation of the vapour of oil of turpentine in one form or another has long been a favourite remedy in pulmonary diseases. The advantages derived from the free use of terebinthinate embrocations in lung diseases have been referred by many to the inhalations of dilute vapour of oil of turpentine necessitated thereby. The dangers which some have seen (Dr Stokes especially) from the inhalations of vapour of oil of turpentine are only to be accounted for by the circumstance that these vapours were used in too concentrated a form. No one should think of administering any form of antiseptic vapour of a strength and concentration capable of exciting irritation in the air passages.

Turpentine vapour is not only a valuable antiseptic when properly diluted, but it is also an exceedingly useful astringent, and is especially indicated in those cases of phthisis where there is profuse secretions from co-existing bronchial catarrh.

A useful formula for dry inhalations is a mixture of one drachm of spirits of turpentine,

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one drachm of creasote, and six drachms of spirits of chloroform. From five to ten drops at a time of this mixture should be dropped on the sponge of an inhalation respirator.

An atmosphere more or less charged with turpentine vapour may be produced around the patient by rubbing the back and front of the chest freely with Stokes's liniment at bedtime. This consists of—

R. Spirit. Terebinthinæ	.	.	3iij.
Acid. Acetici	.	.	3ss.
Vitelli Ovi	.	.	j.
Ol. Limonis	.	.	3j.
Aquæ Rosmarini	.	.	3iiss.

A good method also is to rub up a drachm of oil of turpentine with thirty grains of carbonate of magnesia and two or three ounces of water ; a teaspoonful or two of this mixture thrown on hot water readily gives off turpentine vapour.

EUCALYPTOL OR OIL OF EUCALYPTUS

This is a deservedly popular antiseptic. It has a more agreeable odour than many other antiseptic volatile substances, and is on that

account to be preferred in many cases. The oil of eucalyptus is much cheaper than eucalyptol, and is quite as useful for inhalation. This volatile oil is obtained from the fresh leaves of the *Eucalyptus globulus*. The more volatile liquid, eucalyptol, is obtained from the former by purification with caustic potash and fused chloride of calcium. Its powerful antiseptic properties have been well ascertained, and the eucalyptus gauze is an elegant antiseptic dressing introduced by Mr Lister. A pleasant and useful formula for the inhalation of eucalyptol is the following :—Eucalyptol four drachms, gum camphoræ, twenty grains ; oil of gaultheria, one drachm ; spirits of chloroform to an ounce.

Ten to twenty drops of this may be inhaled at a time, dropped on the sponge of an inhalation respirator.

THE OIL OF GAULTHERIA

Mentioned in the preceding formula is an antiseptic volatile oil with a pleasant odour and consisting largely of salicylate of methyl.

THYMOL

This is a solid crystalline substance readily soluble in alcohol, ether, or glacial acetic acid. It is homologous with phenol or phenyl alcohol (carbolic acid), and has been used as an antiseptic in the place of carbolic acid when the odour of the latter is found disagreeable.

It has a powerful aromatic smell, resembling that of the crude oil of thyme, from which it is obtained. Its vapour has appeared to me to be rather pungent and irritating. It is a very active deodoriser. Wood observes that it is costly and has no marked advantages in its favour. Moreover, he states that, in America, its fragrant odour has been observed to attract swarms of flies, a decided drawback to its use for continuous inhalation.

It can be used dissolved in spirits of chloroform, either alone or mixed with other vaporisable antiseptics.

CAMPHOR

This substance has long been reputed an antiseptic, and its antiseptic properties are

probably considerable. One drawback to its use is that it diffuses from its solutions very rapidly, and is on that account rather pungent and overwhelming when used as a dry inhalation. Many persons like the odour of camphor and for such it may be added to any of the other antiseptic vaporisable substances. It is also somewhat sedative, and tends to relieve cough. It is freely soluble in chloroform, ether, rectified spirit, and in volatile oils. Three parts of camphor rubbed up with one part of crystals of carbolic acid forms a clear solution very suitable for dry inhalation. From three to ten drops at a time should be dropped on the sponge of an inhalation respirator.

TEREBENE

This antiseptic body, which is largely used as a disinfectant and deodorant, is a modification of oil of turpentine. When oil of turpentine is repeatedly distilled with a small quantity of strong sulphuric acid, it is converted into two inactive modifications: *Terebene*, $C_{10}H_{16}$, boiling at 160° , and *Colophene*, $C_{20}H_{32}$, boiling at a very high temperature.

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Terebene has a more agreeable odour than turpentine or carbolic acid, and may be conveniently used in the place of either as a vaporisable antiseptic.

A mixture of equal parts of terebene and oil of eucalyptus makes a good antiseptic inhalation.

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